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POSTOPERATIVE PERIOD IN RHINOSURGERY – PACKINGS, SPLINTS, POSTOPERATIVE CARE – TYPES, NECESSITY, EFFECTIVENESS

AUTHOR'S ABSTRACT

For the dissertation submitted for the degree of Doctor of Science

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Materials related to the defense are available at the Research Department of MU-Varna and published on the Medical University website.

CONTENT

ABBREVIATIONS

PO: Postoperative

ENT: Ear, Nose, Throat

CDC: Centers for Disease Control and Prevention

CMC: Carboxymethylcellulose

IgA, IgE, IgG, IgM, IgD: Immunoglobulin A, E, G, M, D

PVA: Polyvinyl alcohol

OR: Odds ratio

VAS: Visual Analog Scale

I. INTRODUCTION

Nasal obstruction is one of the most common symptoms observed in otorhinolaryngology practice. It is associated with a reduced quality of life and often necessitates surgical intervention. In most patients suffering from impaired nasal breathing, there are numerous anatomical factors that decrease nasal airway space. These include septal deviation, hypertrophy of the nasal turbinates, collapse of the external nasal valve, and the presence of spurs and ridges.

To improve patient complaints, septoplasty and reduction of the nasal turbinates, also known as conchotomy, are among the most frequently performed surgical interventions carried out by otorhinolaryngology specialists.

After such operations, various types of packing and nasal splints (plates) are used in the postoperative period, which play a crucial role in determining the surgical outcome.

The purposes of using intranasal splints and packings include:

- Preventing the formation of synechiae,
- Preventing the development of septal hematomas,
- Maintaining the corrected position of the septum,
- Reducing dead space between the subperichondrial layers,
- Controlling postoperative bleeding.

For these purposes, a wide variety of materials are available. The choice of intranasal packing depends on the surgeon’s preferences, experience, ease of application and removal, the material's cost, effectiveness, and patient comfort—particularly regarding pain or discomfort during removal. These factors collectively influence the selection and application of intranasal packing.

Considering these factors for the optimal choice of intranasal packing after rhinological surgeries, the literature lacks a unified consensus regarding the use of intranasal packings and splints.

Since the early 21st century, the method of transseptal mucosal sutures after septoplasty has been used as a reliable alternative to intranasal packing. More recent studies recommend using intranasal splints instead of packings, reporting positive effects on reducing bleeding frequency, enhancing patient comfort, preventing erosion and trauma to the nasal mucosa, and reducing the development of synechiae.

Regarding nasal surgeries, patients fear the postoperative period and recovery more than the surgery itself. Today, it is widely recognized among prospective patients that nasal surgery may require packing or, even if it does not, the postoperative period is not ideal and may cause discomfort.

Patients who have undergone intranasal packing report that the standard packing duration of one to five days was the most unpleasant part of the entire experience. Patient tolerance levels vary significantly, but whether packed or unpacked, a blocked nasal airway can cause some

anxiety and even claustrophobia. One of the most important aspects of the postoperative period is ensuring a functional nasal airway, which is the most optimal option for the patient's safety and comfort.

The goal of postoperative care is to promote healing of traumatized tissues and early recovery of the mucosa, reduce local inflammation, and minimize complaints during the early postoperative phase. Thanks to postoperative care, long-term improvements in quality of life are achieved, the surgical outcome is optimized, and the risk of requiring a reoperation is reduced. The type and duration of treatment depend on the patient's condition, the performed surgery, and patient-specific variables.

Postoperative care begins, as after any surgery under general anesthesia, with patient bed rest, antihypertensive control—extremely important regarding postoperative bleeding—management of concomitant conditions, control of postoperative side effects such as dizziness, nausea, and vomiting, support for overall recovery, food and fluid intake, and an appropriate diet.

The postoperative period after rhinological surgery plays just as important a role as the quality of the surgical intervention itself. Routine or otherwise, antibiotic prophylaxis may be applied, patients are instructed to rinse their noses with various solutions, nasal sprays (vasoconstrictors or corticosteroids) are prescribed, and depending on the inserted packing or splints, various steps are taken for their removal, as well as hygienic care while they remain in the nose.

From the literature data, it is established that there is still no unified consensus regarding the best impact of the various materials used for intranasal packing, as well as the required duration of packing retention. It is still debated whether all techniques—intranasal packing, septal splints, transseptal sutures—are necessary or whether they are interchangeable.

The aforementioned determines the aim of this work: to study the effects of various intranasal packings and splints after rhinological surgery and, based on this, to develop guidelines for their use and the management of the postoperative period.

II. AIM AND OBJECTIVES

2.1 Aim:

To investigate the effects of various intranasal packings and splints following (rhino)septoplasty, thereby developing guidelines for their use and the management of the postoperative period.

2.2 Objectives:

1. To study and classify the types of postoperative intranasal packings and splints described in the literature.
2. To evaluate the role of postoperative intranasal packings and splints on early and late complications following rhinological surgeries.
3. To conduct surveys among patients undergoing rhinological surgeries regarding the effects of postoperative intranasal packings and splints on pain and comfort during the postoperative period.
4. To assess the effects of postoperative intranasal packings and splints on mucociliary clearance using the saccharin test.
5. To evaluate the effects of postoperative intranasal packings and splints on bacterial colonization and the risk of infection.
6. To develop guidelines for the use of intranasal packings and splints following septoplasty.

III. MATERIALS AND METHODS

3.1 Subject of Study

3.2 Object of Study

A total of 98 patients were examined during the postoperative period following nasal surgeries—(rhino)septoplasty—where intranasal packings and splints were applied. These patients were treated at the ENT Clinic of the University Hospital "Saint Marina."

The patients were selected based on strict inclusion and exclusion criteria for the study.

Inclusion Criteria:

- Individuals hospitalized at University Hospital "Saint Marina," who signed the general hospital Declaration of Informed Consent.
- Patients over 18 years of age undergoing planned surgical procedures, such as septoplasty or rhinoseptoplasty, and who provided consent to participate in the study by signing the specific informed consent declaration for the research.

Exclusion Criteria:

- Patients under 18 years of age.
- Patients suffering from psychiatric disorders.
- Patients with known oncological diseases of the head and neck.

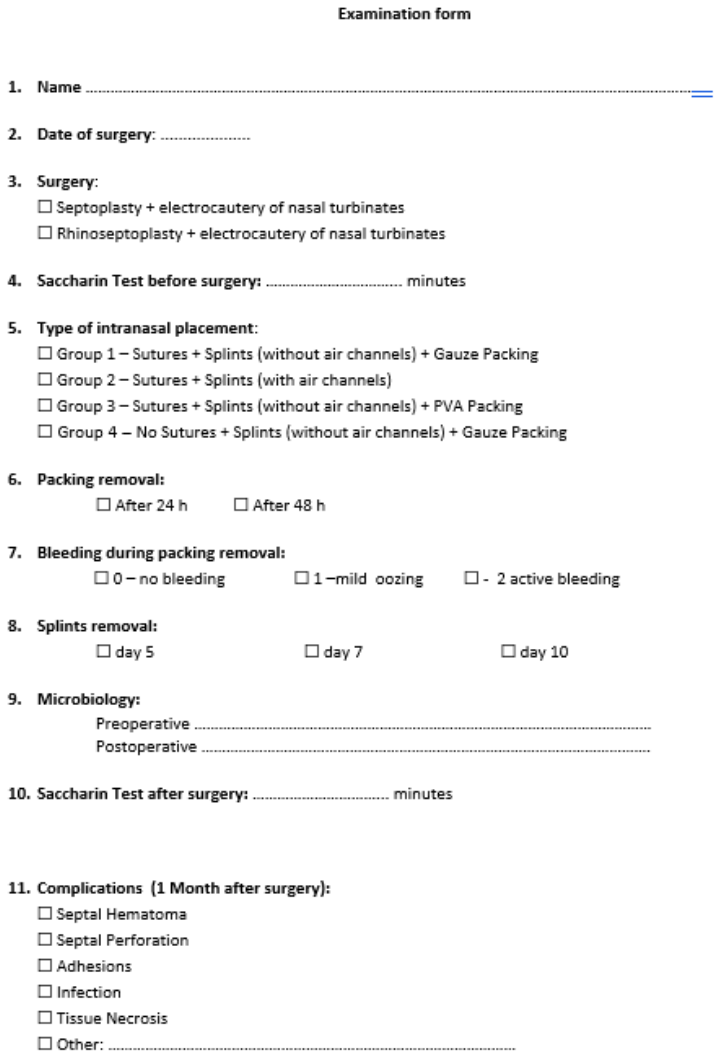
3.2.1 Specific Investigations

To achieve the scientific research aim and address the formulated objectives, data from patients who underwent (rhino)septoplasty were studied and analyzed. The research followed a standard protocol, which included:

1. **History and ENT Examination:**
    - Rhinoscopy, pharyngoscopy, and otoscopy were conducted.
    - A standardized form (Fig. 6) was completed, recording the type of surgical intervention, the results of the saccharin test, and microbiological examination outcomes.
    - The group classification of the patient was noted.
2. **Postoperative Protocol:**
    - The duration for removing the packing was recorded (after 24 or 48 hours, if applicable).

- Bleeding intensity during packing removal was evaluated on the following scale:
  - **0**: No bleeding,
  - **1**: Mild oozing,
  - **2**: Active bleeding.
- The timeline for removing the silicone splints was documented.

3. **Follow-Up Rhinoscopy:**
   - Rhinoscopy was performed to monitor for early complications (on the 5th, 7th, or 10th postoperative day).
4. **Comprehensive Evaluation:**
   - The nasal condition was assessed through rhinoscopic examination before the operation, immediately after surgery, on the 7th postoperative day, and one month after surgery.
   - This included monitoring for early and late complications, as well as evaluating treatment outcomes.



Examination form

1. **Name** .....
2. **Date of surgery**: .....
3. **Surgery**:
   - ☐ Septoplasty + electrocautery of nasal turbinates
   - ☐ Rhinoseptoplasty + electrocautery of nasal turbinates
4. **Saccharin Test before surgery:** ..... minutes
5. **Type of intranasal placement**:
   - ☐ Group 1 – Sutures + Splints (without air channels) + Gauze Packing
   - ☐ Group 2 – Sutures + Splints (with air channels)
   - ☐ Group 3 – Sutures + Splints (without air channels) + PVA Packing
   - ☐ Group 4 – No Sutures + Splints (without air channels) + Gauze Packing
6. **Packing removal:**
   - ☐ After 24 h ☐ After 48 h
7. **Bleeding during packing removal:**
   - ☐ 0 – no bleeding ☐ 1 –mild oozing ☐ - 2 active bleeding
8. **Splints removal:**
   - ☐ day 5 ☐ day 7 ☐ day 10
9. **Microbiology:**
   - Preoperative .....
   - Postoperative .....
10. **Saccharin Test after surgery:** ..... minutes
11. **Complications (1 Month after surgery):**
    - ☐ Septal Hematoma
    - ☐ Septal Perforation
    - ☐ Adhesions
    - ☐ Infection
    - ☐ Tissue Necrosis
    - ☐ Other: .....

Fig. 6. Patient Examination Form

3.3. Research Methods

3.3.1 Survey Method (Fig. 7)

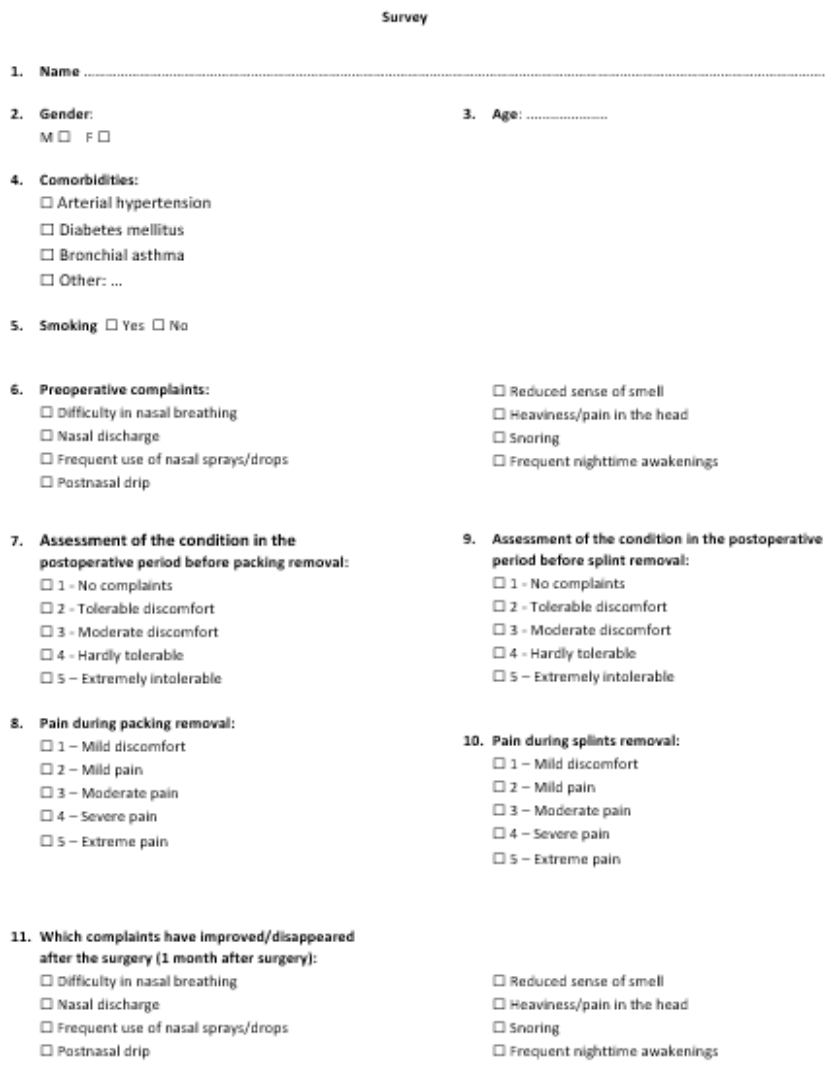
All participants were surveyed to gather information on demographic data, including their age, sex, occupation, and other relevant personal details. The survey also covered medical history, focusing on the presence of any comorbidities or underlying conditions, as well as smoking habits, including the frequency and duration of tobacco use.

The participants were questioned about their nasal complaints before surgery, specifically the symptoms they experienced and their severity. Additionally, they were asked to evaluate how these complaints improved after the surgical intervention. The survey included questions on the

participants' experiences during the retention period of the packing, assessing their condition while the packing remained in place and the presence and intensity of pain or discomfort they experienced during this time.

The survey also explored their experience during the removal of the packing, focusing on the pain and discomfort associated with the process. Furthermore, the participants were asked to evaluate their condition while silicone splints were in place and to describe any pain or discomfort experienced during the removal of the splints.

This comprehensive survey method provided valuable insights into the participants' preoperative and postoperative experiences, as well as their tolerance and reactions to different intranasal interventions.



Survey

1. **Name** .....

2. **Gender**:
   M ☐ F ☐

3. **Age**: .....

4. **Comorbidities:**
   ☐ Arterial hypertension
   ☐ Diabetes mellitus
   ☐ Bronchial asthma
   ☐ Other: ...

5. **Smoking** ☐ Yes ☐ No

6. **Preoperative complaints:**
   ☐ Difficulty in nasal breathing
   ☐ Nasal discharge
   ☐ Frequent use of nasal sprays/drops
   ☐ Postnasal drip
   ☐ Reduced sense of smell
   ☐ Heaviness/pain in the head
   ☐ Snoring
   ☐ Frequent nighttime awakenings

7. **Assessment of the condition in the postoperative period before packing removal:**
   ☐ 1 - No complaints
   ☐ 2 - Tolerable discomfort
   ☐ 3 - Moderate discomfort
   ☐ 4 - Hardly tolerable
   ☐ 5 – Extremely intolerable

8. **Pain during packing removal:**
   ☐ 1 – Mild discomfort
   ☐ 2 – Mild pain
   ☐ 3 – Moderate pain
   ☐ 4 – Severe pain
   ☐ 5 – Extreme pain

9. **Assessment of the condition in the postoperative period before splint removal:**
   ☐ 1 - No complaints
   ☐ 2 - Tolerable discomfort
   ☐ 3 - Moderate discomfort
   ☐ 4 - Hardly tolerable
   ☐ 5 – Extremely intolerable

10. **Pain during splints removal:**
    ☐ 1 – Mild discomfort
    ☐ 2 – Mild pain
    ☐ 3 – Moderate pain
    ☐ 4 – Severe pain
    ☐ 5 – Extreme pain

11. **Which complaints have improved/disappeared after the surgery (1 month after surgery):**
    ☐ Difficulty in nasal breathing
    ☐ Nasal discharge
    ☐ Frequent use of nasal sprays/drops
    ☐ Postnasal drip
    ☐ Reduced sense of smell
    ☐ Heaviness/pain in the head
    ☐ Snoring
    ☐ Frequent nighttime awakenings

Fig. 7. Patient Feedback Survey

3.3.2 Microbiological Examination of Nasal Secretions

For each participant, a microbiological examination of nasal secretions was conducted using a sterile swab. This was performed both before the surgery and one month postoperatively.

3.3.3 Saccharin Test

All participants underwent a saccharin test prior to surgery and on the 30th postoperative day.

The saccharin test involves placing a 1 mm saccharin particle on the medial surface of the inferior nasal turbinate, approximately 1 cm from its anterior edge. The time (in minutes) it takes for the patient to perceive a sweet taste upon swallowing is measured. (fig. 8)

During the test, the patient is instructed to:

- Avoid consuming food and liquids for at least one hour prior to and during the test.
- Refrain from smoking for at least one hour prior to and during the test.
- Avoid blowing their nose, inhaling deeply, or sneezing if possible.
- Maintain an upright or seated position throughout the test.

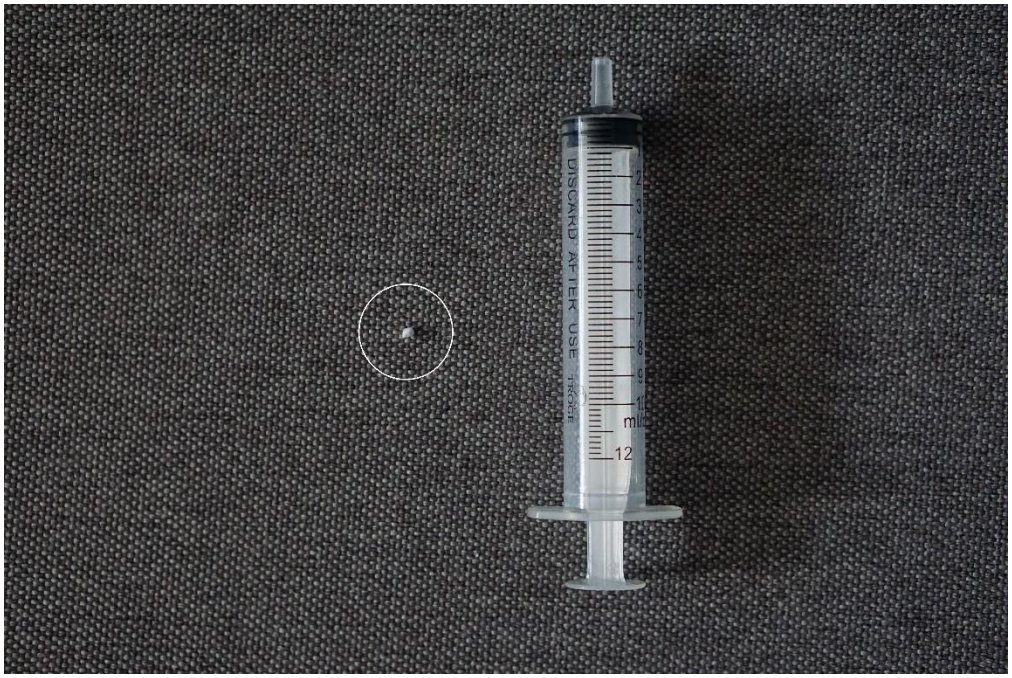


Fig. 8. Saccharin Particle for Saccharin Test

Patient group distribution based on intranasal packing methods

Patients were divided into four study groups according to the methods of intranasal packing applied at the end of the surgical procedure. This classification was based on the type of material

used, which included transseptal absorbable sutures, silicone splints with or without air channels (stitched at the anterior end), gauze packing, or PVA packing. The four groups were as follows:

- **Group 1**:
  - Transseptal sutures + silicone splints (without air channels) + gauze packing.
- **Group 2**:
  - Transseptal sutures + silicone splints (with air channels).
- **Group 3**:
  - Transseptal sutures + silicone splints (without air channels) + PVA packing.
- **Group 4**:
  - No transseptal sutures + silicone splints (without air channels) + gauze packing.

The types of packings and splints used in each group are illustrated in **Figs. 9-12**.

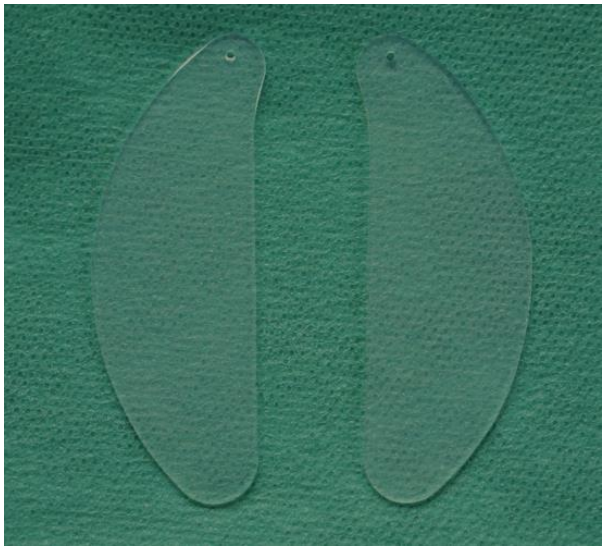


Fig. 9. Silicone splints without air channels

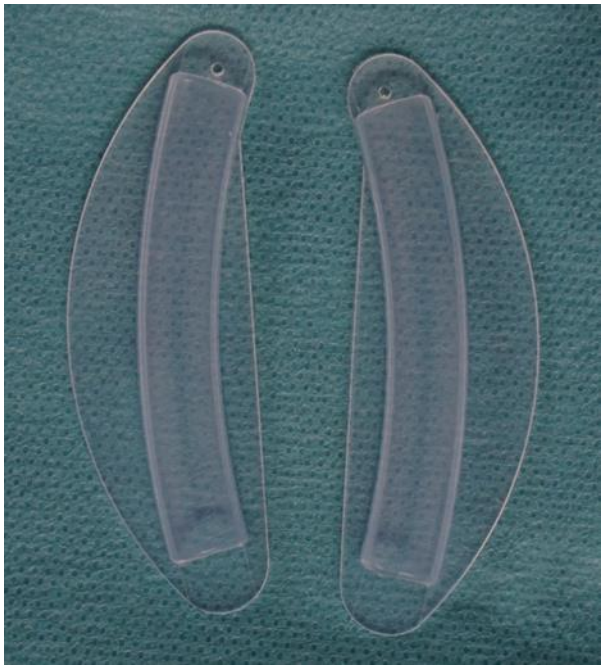


Fig. 10. Silicone splints with air channels

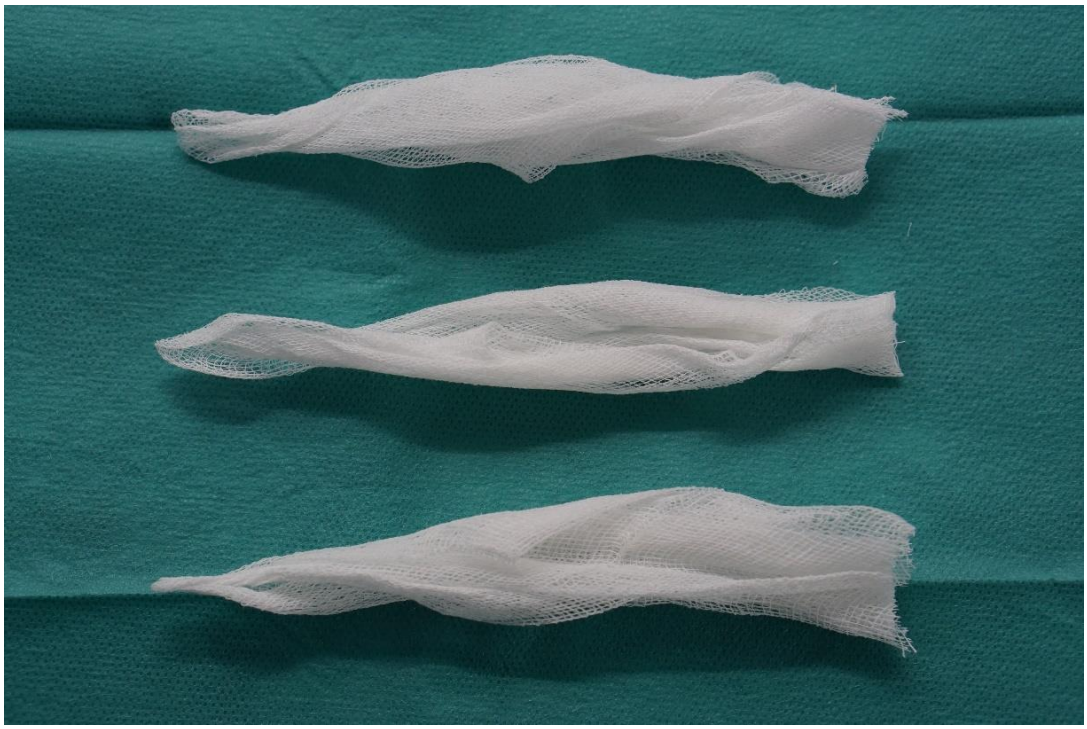


Fig. 11. Gauze packing

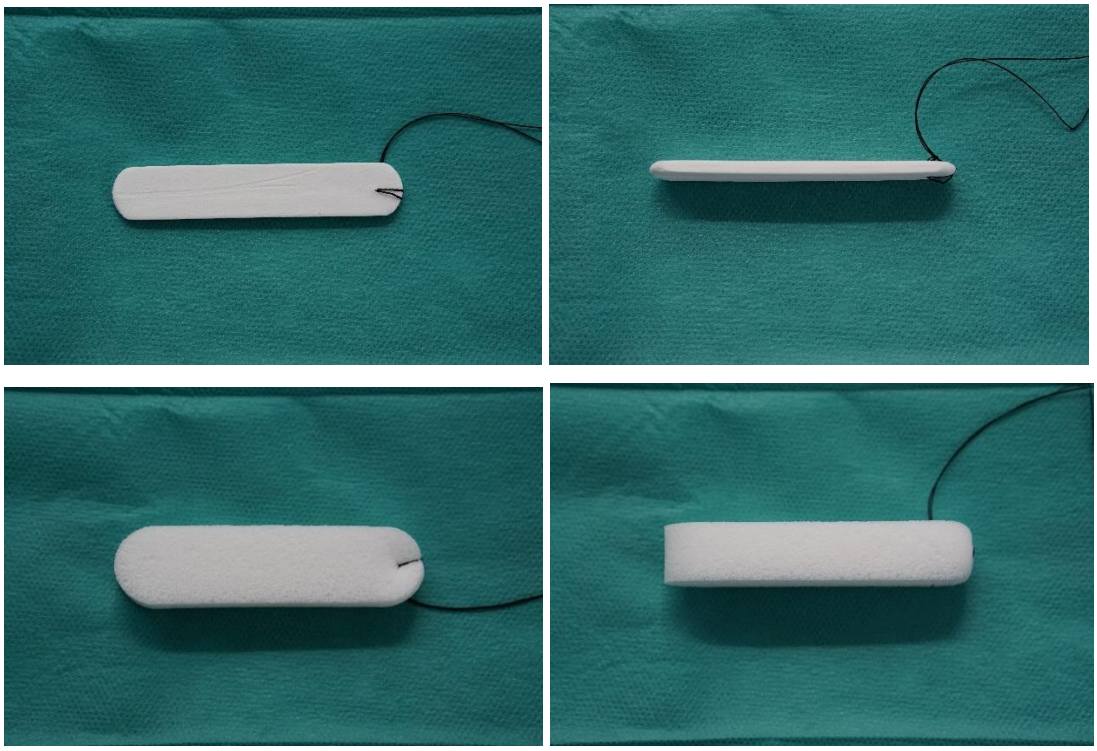


Fig. 12. PVA packing in deflated and inflated state

3.3.4 Statistical Methods

The following statistical methods were applied:

- **Analysis of Variance (ANOVA)**: Used to evaluate whether the influence of a particular factor is statistically significant.
- **Variation Analysis**: Applied to examine the quantitative characteristics of the studied indicators.
- **Risk Analysis (Odds Ratio - OR)**: Evaluated the likelihood of a specific event occurring.
- **Correlation Analysis**: Assessed the dependence between studied indicators. The strength of the relationship between variables was evaluated using Pearson's (r) and Spearman's (p) correlation coefficients:
    - **Spearman's Coefficient**: Measures correlation based on monotonic relationships.
    - **Pearson's Coefficient**: Measures correlation based on linear relationships.

The degree of association between variables was interpreted as follows:

- $0<r(p)<0.30 < r(p) < 0.30<r(p)<0.3$: Weak correlation.
- $0.3<r(p)<0.50.3 < r(p) < 0.50.3<r(p)<0.5$: Moderate correlation.
- $0.5<r(p)<0.70.5 < r(p) < 0.70.5<r(p)<0.7$: Significant correlation.

- $0.7<r(p)<0.90.7 < r(p) < 0.90.7<r(p)<0.9$: High correlation.
- $0.9<r(p)<10.9 < r(p) < 10.9<r(p)<1$: Very high correlation.
- **Regression Analysis**: Used to evaluate possible functional dependencies between indicators and study cause-and-effect relationships.
- **Comparative Analysis (Hypothesis Testing)**: Applied using $\chi 2 \backslash chi^2 \chi 2$ and Student's t-tests for comparing quantitative and qualitative indicators and examining the differences between them.
- **Graphical and Tabular Representation**: Employed to visualize the results obtained.

The data was processed using the statistical software package IBM SPSS for Windows, v.20.0.

For all analyses conducted, a significance level of $p<0.05p < 0.05p<0.05$ was considered acceptable, with a 95% confidence interval.

Ethical Considerations

The study was conducted after obtaining approval from the Ethics Committee for Research at the Medical University of Varna (Protocol/Decision No. 103, meeting on May 27, 2021). All participants in the study signed informed consent forms.

CHAPTER THREE: RESULTS AND DISCUSSION

3.1 Characteristics of the Study Group

A total of 98 patients were studied, with an average age of 36.4 ± 11.6 years, ranging from 18 to 68 years (**Fig. 13**). The majority of the patients were male, accounting for 68.4% (n=67) of the group.

No significant difference in age was observed between genders. The average age for males was 35.9 years, while the average age for females was 37.4 years.

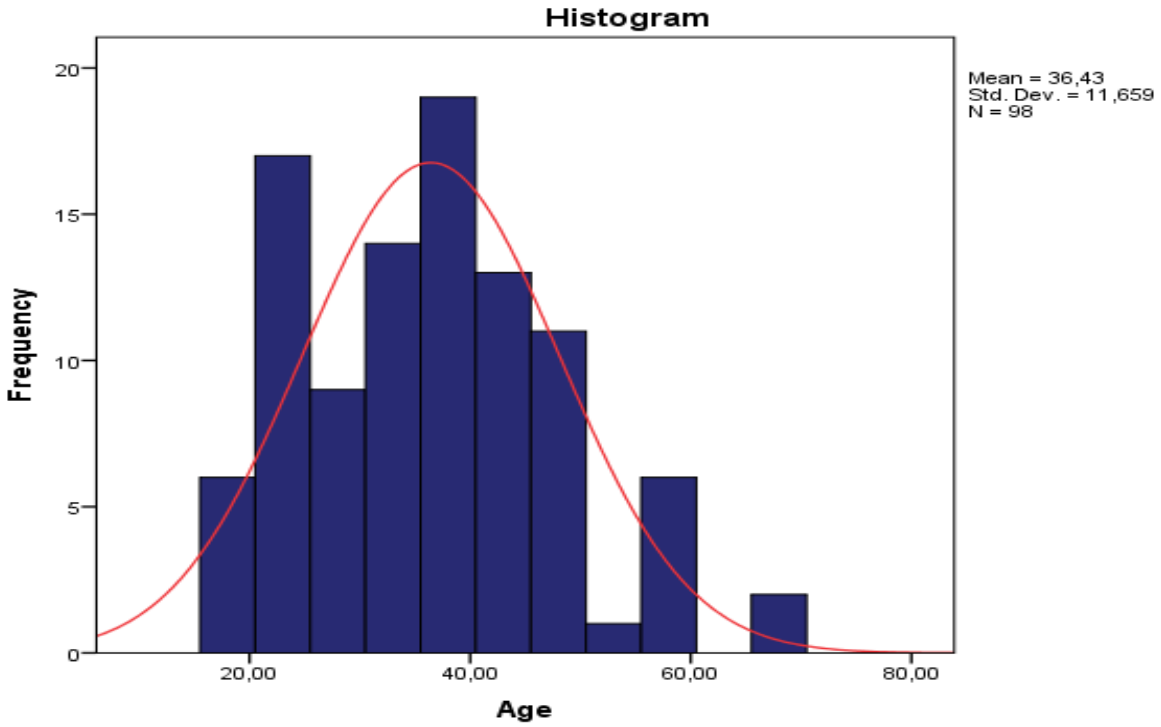


Fig. 13. Age distribution of patients

In the present study, **11.2%** of patients (n=11) had hypertension, while those with diabetes and asthma accounted for **4.1%** each (n=4). Only one patient had both diabetes and hypertension. Among hypertensive patients, males predominated (**72.7%** male vs. **27.3%** female), whereas the gender distribution for patients with diabetes and asthma was even.

A significant difference was observed in the age of patients with hypertension compared to those without (**p<0.001**). The average age of hypertensive patients was **50.7 years**, compared to **34.6 years** for those without hypertension. A moderate correlation between age and hypertension was identified (**r=0.438; p<0.001**), indicating that the prevalence of hypertension increases with age.

A similar trend was observed for patients with diabetes. The average age of diabetic patients was **53 years**, compared to **35.7 years** for those without diabetes (**p=0.003**). A weak to moderate

correlation was found between age and diabetes (**r=0.295; p=0.003**), suggesting that the frequency of diabetes increases with age.

For patients with asthma, no age difference was identified.

Just under half of the study participants were smokers (**42.9%; n=42**), with no observed age difference between smokers and non-smokers.

The majority of patients underwent septoplasty (**90.8%**). The characteristics of patients based on the type of surgical intervention are presented in **Table 4**.

Indicator		Septoplasty (n=89)	Rhinoseptoplasty (n=9)
Age	mean±SD (range)	35.8 ±11.7 (18-68)	42.4±10.1 (27-60)
Gender	Male	66 (74.2 %)	1 (11.1 %)
	Female	23 (25.8 %)	8 (88.9%)
Hypertension	Yes	10 (11.2 %)	1 (11.1 %)
Diabetes	Yes	3 (3.4 %)	1 (11.1 %)
Asthma	Yes	4 (4.5 %)	0
Smoking	Yes	39 (43.8 %)	3 (33.3 %)

Table 4. Characteristics of patients based on type of surgical intervention

A moderate correlation was found between gender and the type of surgical intervention (**r=0.392; p<0.001**), indicating that septoplasty is more commonly performed in men (**74.2%**), while rhinoseptoplasty is predominantly observed in women (**88.9%**).

Slightly less than one-fifth (**18.4%**) of the patients underwent surgery without transseptal mucosal sutures, relying only on splints and packing. The distribution of patients based on the type of intranasal application is shown on **Fig. 14**.

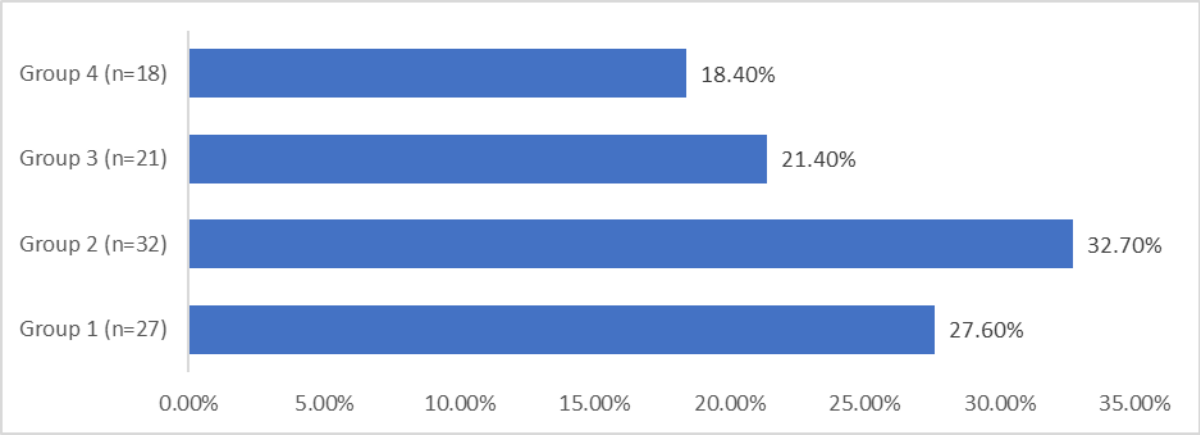


Fig. 14. Distribution of patients based on type of intranasal application

This figure illustrates the distribution of patients according to the type of intranasal materials used during the surgical procedure. It highlights the proportions of patients receiving different combinations of transseptal sutures, splints, and packing materials.

No significant difference was observed in the average age of patients based on the type of surgical intervention (**Fig. 15**).

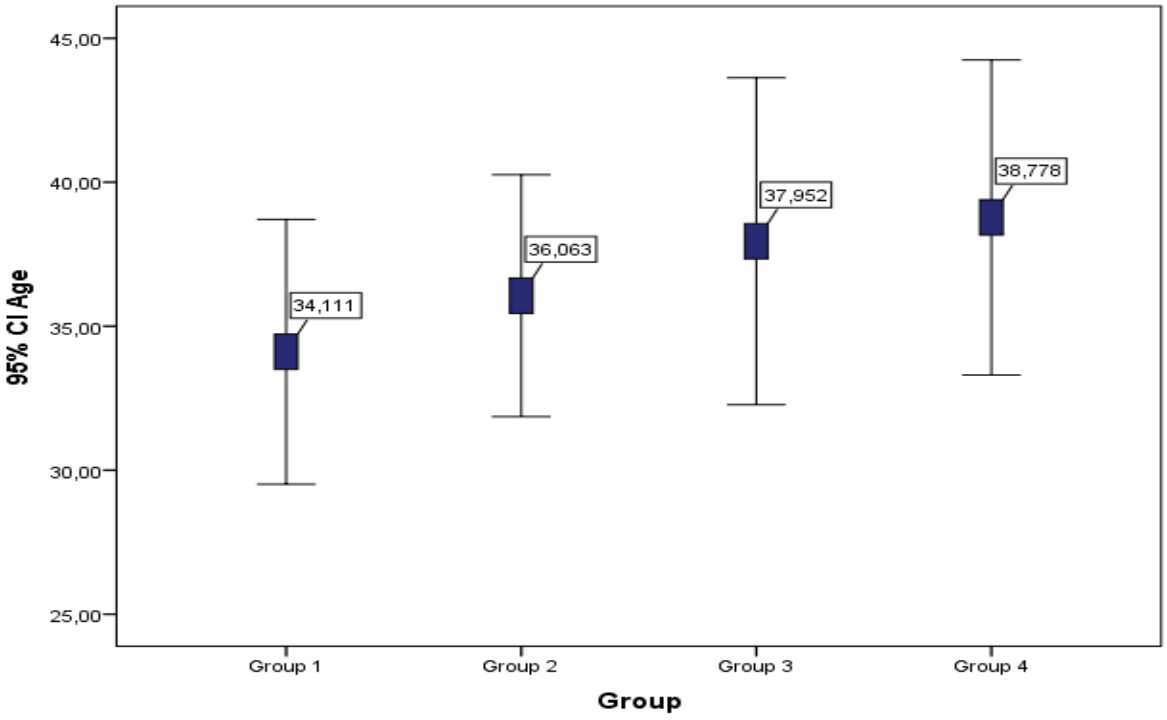


Fig. 15. Average age of patients based on treatment type

Although no substantial differences were observed, it can be noted that there is a slight predominance of women in **Group 3**. (fig. 16) This figure highlights the gender composition within this specific group.

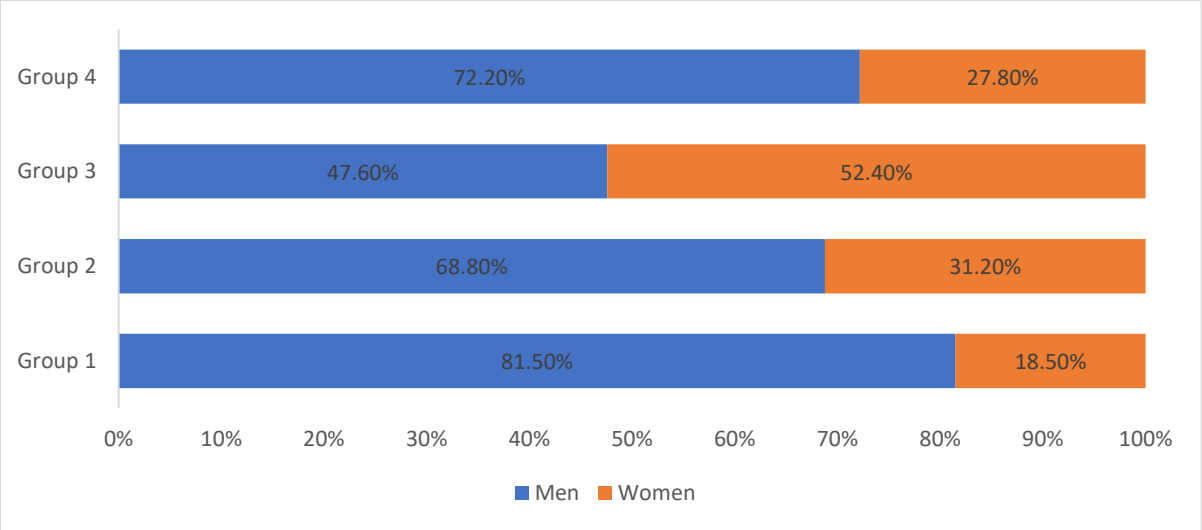


Fig. 16. Distribution of patients based on type of intranasal application and gender

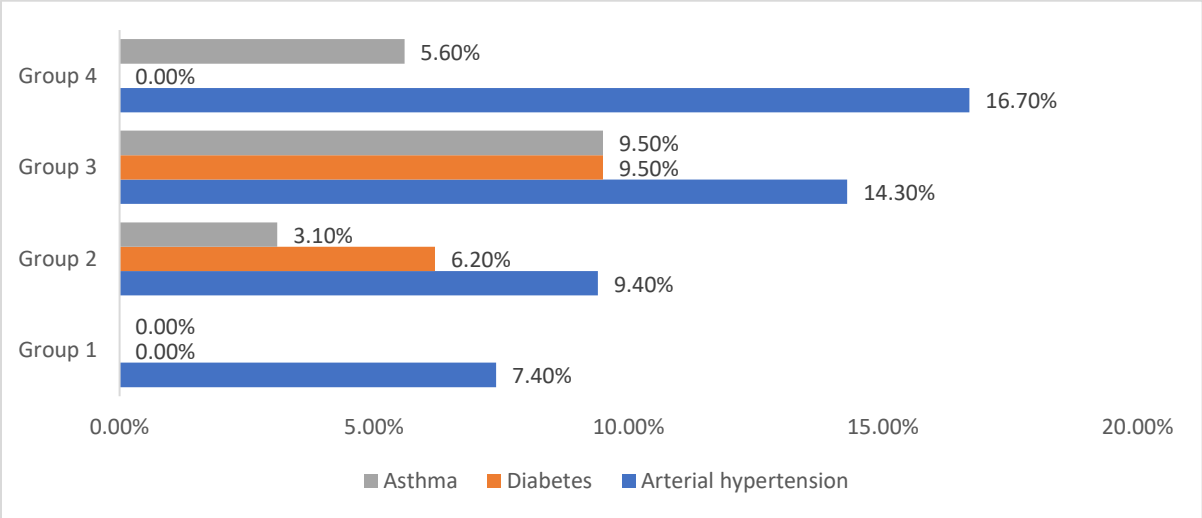


Fig. 17. Distribution of patients based on type of intranasal application and comorbidities

This figure shows the distribution of patients according to the type of intranasal application used and the presence of comorbidities. A higher proportion of patients with hypertension was observed in **Group 3** (14.3%, n=3) and **Group 4** (16.7%, n=3). (fig. 17)

No patients with diabetes or asthma were found in **Group 1**, and **Group 4** had no patients with diabetes. This distribution emphasizes the variation in comorbidities across the different groups.

3.2 Role of postoperative intranasal packings and splints in early and late complications following rhinological surgeries

Complications following rhinological surgeries were observed in only three patients who underwent septoplasty. Among these cases, two patients developed a **septal hematoma**, and one patient developed **synechiae**.

- **Case 1**: A male patient, aged 39, with no hypertension or diabetes, but with asthma and a history of smoking, developed a septal hematoma.
- **Case 2**: A female patient, aged 22, with no hypertension, diabetes, or asthma, also developed a septal hematoma.

Both patients were part of **Group 4**.

The patient who developed synechiae belonged to **Group 1**. She was a 28-year-old female with no hypertension, diabetes, or asthma, and she was a non-smoker.

No complications were observed in **Group 2** and **Group 3**. The frequency of early and late complications following rhinological surgeries was minimal, suggesting that the surgical interventions applied in this study are characterized by a high level of safety and a minimal risk of complications for the patient.

3.3 Investigation of the impact of postoperative intranasal packings and splints on pain and comfort during the postoperative period

The evaluation of pain and comfort in the postoperative period is predominantly subjective and largely dependent on the patients' perceptions.

The analysis of pain among respondents revealed that the average pain score during the removal of intranasal packing was **2.71 ± 0.90**, which can be classified as mild to moderate pain.

In this study, **50%** of patients (n=35) reported moderate pain during the removal of the intranasal packing. Meanwhile, **35.7%** of patients (n=25) described experiencing slight discomfort and mild pain. On the other hand, **13.3%** of patients (n=10) reported experiencing severe or very severe pain during packing removal (**Fig. 18**).

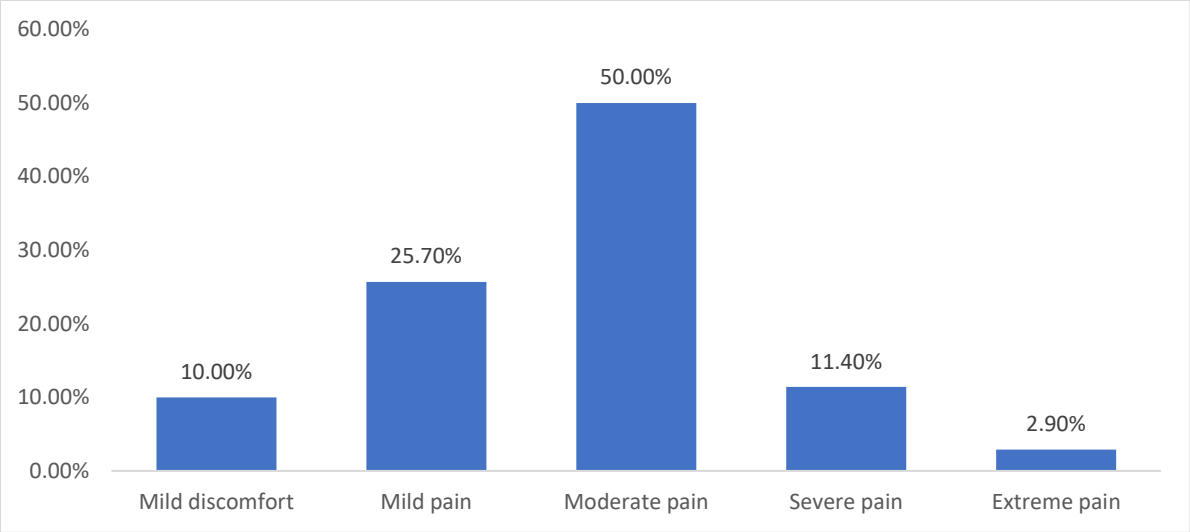


Fig. 18. Pain during packing removal

A direct proportional relationship was identified between the pain experienced during packing removal and the age of the patients (**r=0.255; p=0.033**). This indicates that pain intensity increases as the age of the patients rises.

This finding suggests that with increasing age, patients become more sensitive, and their pain threshold decreases (**Fig. 19**).

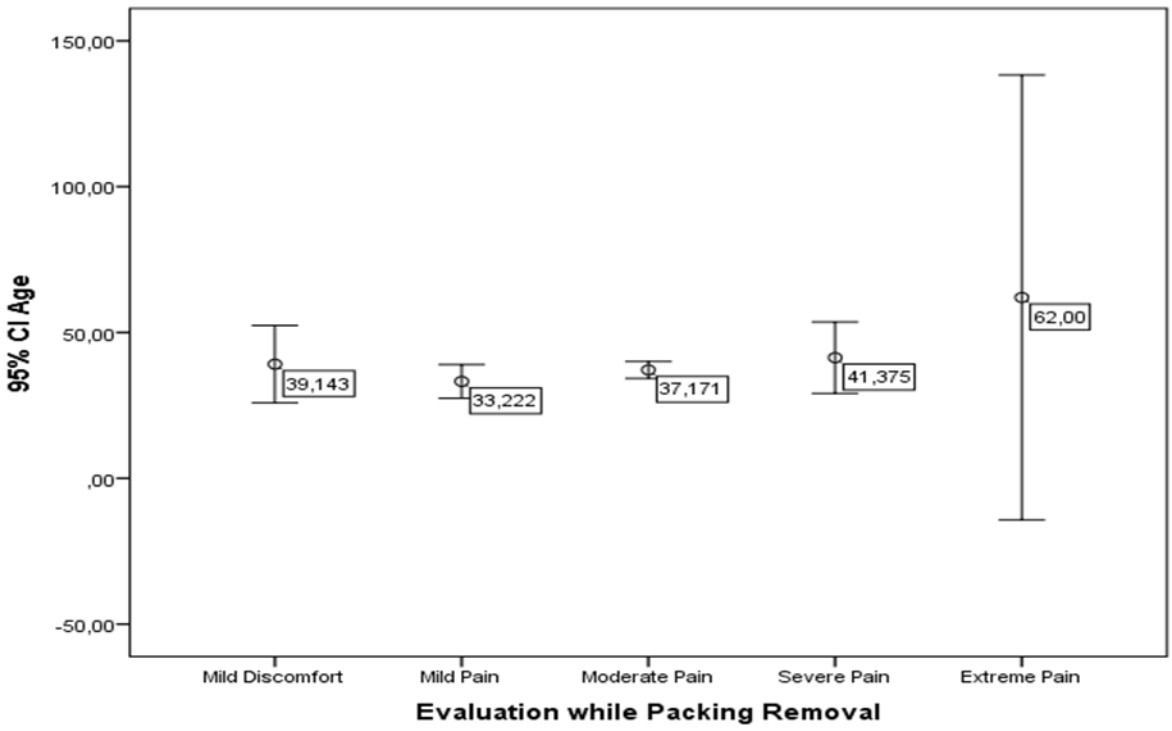


Fig. 19. Average age based on pain perception during packing removal

Gender does not appear to influence patients' perceptions of pain during the removal of intranasal packing. Among the participants, **47.7% of men** and **53.8% of women** reported experiencing moderate pain.

The average postoperative pain score during packing removal was **2.66** for men and **2.81** for women, indicating minimal differences between the genders. Similarly, the proportion of men and women who reported experiencing severe or very severe, unbearable pain was approximately the same (**Fig. 20**).

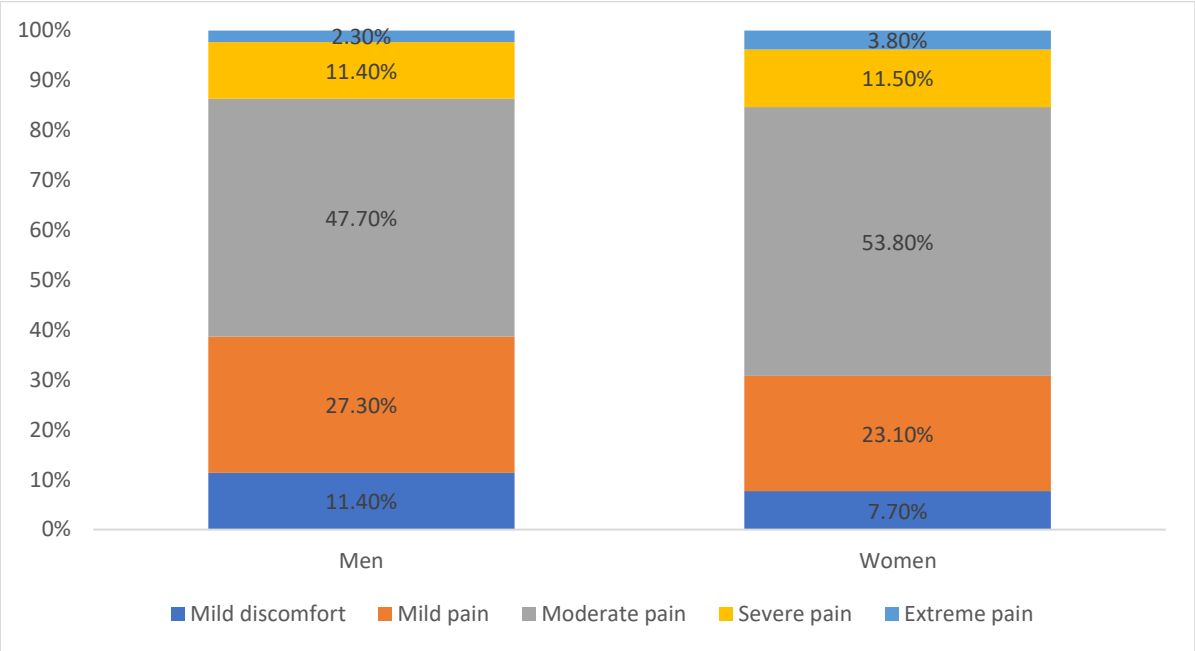


Fig. 20. Distribution of patients by gender and pain during packing removal

The average postoperative pain score during packing removal was **2.76** for patients who underwent septoplasty, leaning more towards **moderate pain**, while for patients who underwent rhinoseptoplasty, the score was **2.28**, indicating **mild pain**.

No significant difference was observed in pain levels during packing removal based on the type of intranasal packing applied. Across all three groups of patients, **moderate pain** was the predominant category (**Table 5**).

			Group		
			Sutures Splints Gauze Packing – **Group 1**	Sutures Splints PVA Packing – **Group 3**	No Sutures, Splints Gauze Packing – **Group 4**
Evaluation while Packing Removal	Mild Discomfort	Count	4	1	2
		% within Group	12,9%	4,8%	11,1%
	Mild Pain	Count	10	4	4
		% within Group	32,3%	19,0%	22,2%
	Moderate Pain	Count	14	12	9
		% within Group	45,2%	57,1%	50,0%
	Severe Pain	Count	3	3	2
		% within Group	9,7%	14,3%	11,1%
	Extreme Pain	Count	0	1	1
		% within Group	0,0%	4,8%	5,6%
Total		Count	31	21	18
		% within Group	100,0%	100,0%	100,0%

Table 5. Distribution of patients by pain perception during packing removal and type of surgical intervention

A significant difference in postoperative pain during packing removal was observed between patients with and without hypertension. The average pain score for patients with hypertension was **3.22**, leaning towards **severe pain**, compared to **2.64** for those without hypertension (**$p<0.05$**).

Among patients with hypertension, **22.2%** reported experiencing severe and unbearable pain. In contrast, no cases of unbearable pain were recorded among patients without hypertension (**$p=0.001$**) (**Fig. 21**).

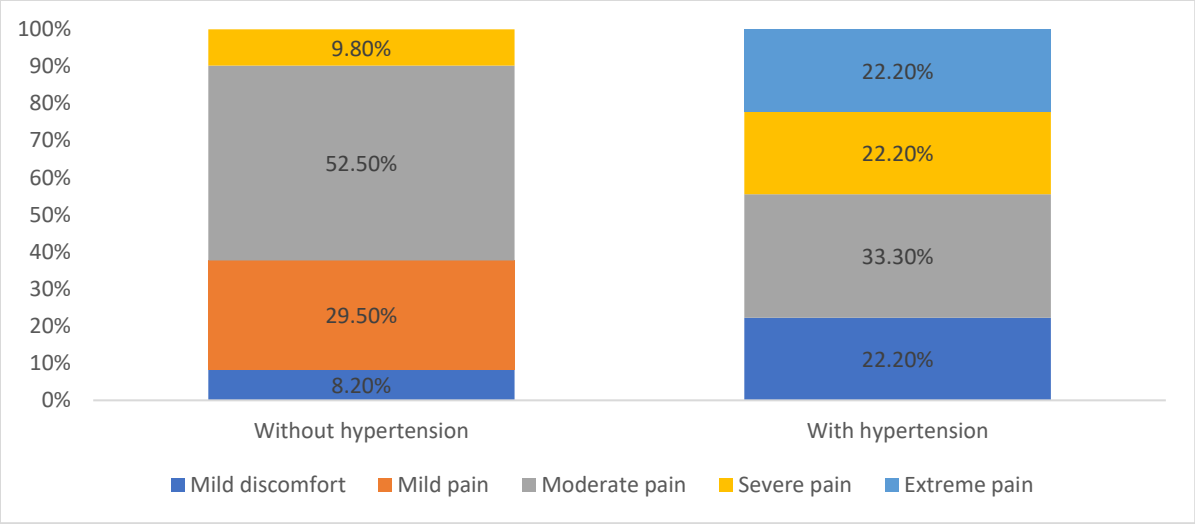


Fig. 21. Distribution of patients by hypertension status and pain during packing removal

No significant difference was found in postoperative pain during packing removal between patients with and without diabetes. The average pain score was **2.75** for patients with diabetes and **2.71** for those without diabetes.

Among patients with diabetes, **50%** experienced severe pain, while **53.0%** of patients without diabetes reported moderate pain (**Fig. 22**).

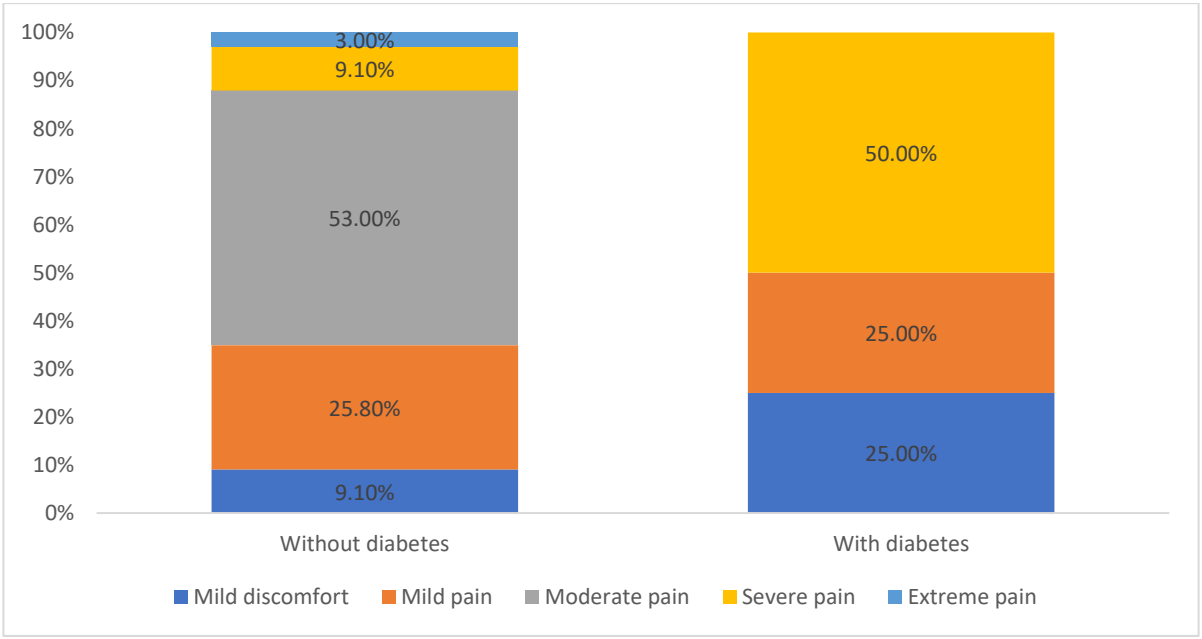


Fig. 22. Distribution of patients by diabetes status and pain during packing removal

All patients with asthma reported experiencing **moderate postoperative pain** during the removal of intranasal packing.

Another factor used to assess the impact of postoperative intranasal packing on patient comfort was their condition during the postoperative period before packing removal. The **average comfort score** in this period was **3.68 ± 1.04**, indicating a level of discomfort ranging from **moderate to severely intolerable**.

The results revealed that complaints regarding discomfort varied significantly, with the most common experiences falling within the range of **moderate to severe, intolerable discomfort** (**Fig. 23**).

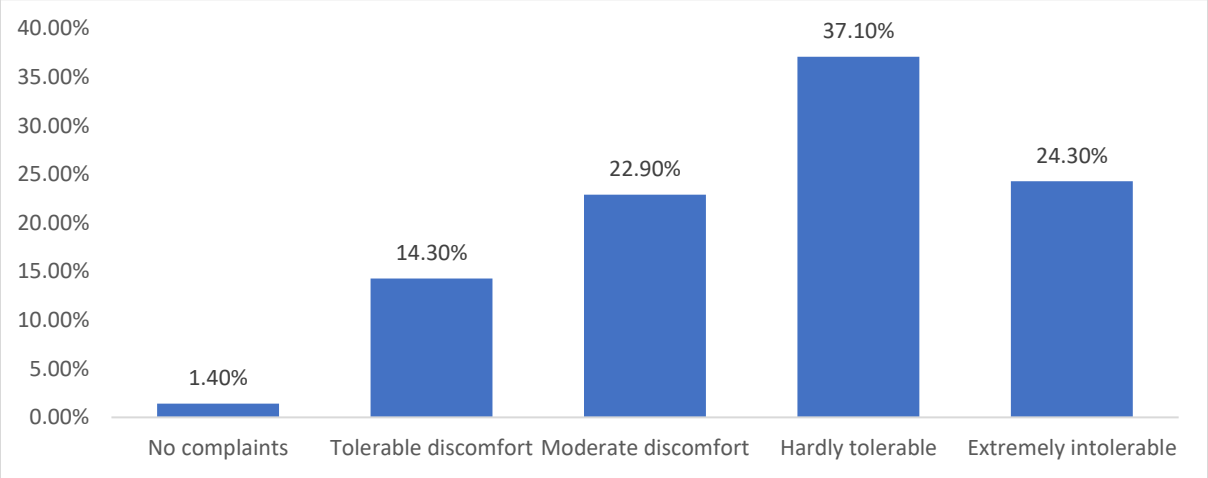


Fig. 23. Evaluation of patients' comfort in the postoperative period before packing removal

No correlation was found between the reported discomfort levels before packing removal and the age of the patients.

Although no statistically significant difference was observed, it can be noted that women reported **greater discomfort** in the postoperative period before packing removal. None of the female patients indicated an absence of complaints during this phase (**Fig. 24**).

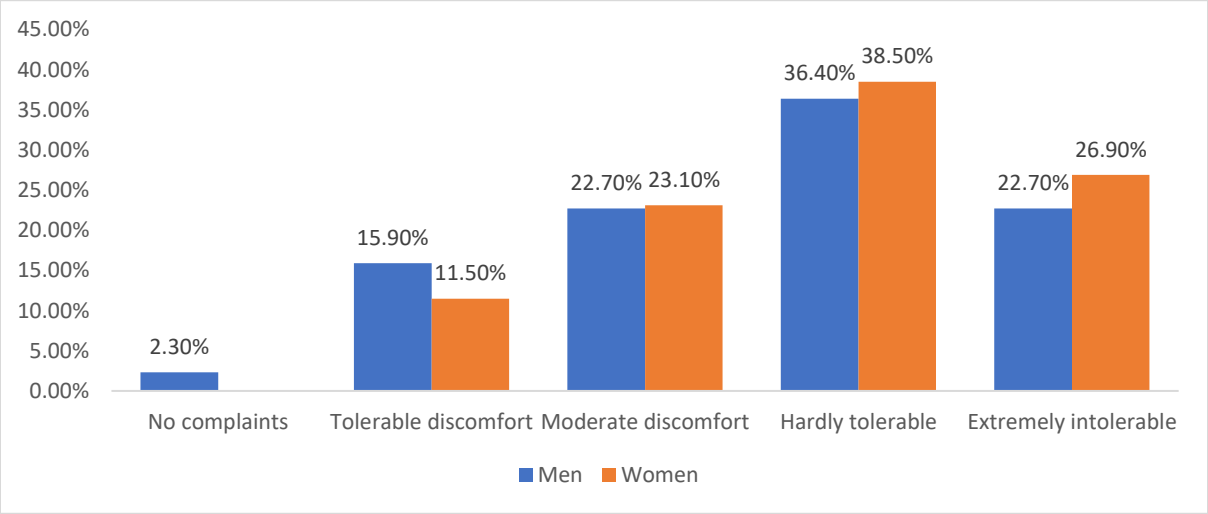


Fig. 24. Evaluation of patient condition in the postoperative period before packing removal by gender

From the perspective of smoking, it was observed that smokers reported a higher relative proportion of **severe** and **intolerable discomfort** during the postoperative period before packing removal. Specifically:

- **38.2%** of smokers reported **severe discomfort**,
- **26.5%** of smokers reported **intolerable discomfort** (**Fig. 25**).

These findings suggest that smoking may contribute to heightened discomfort levels in the postoperative period.

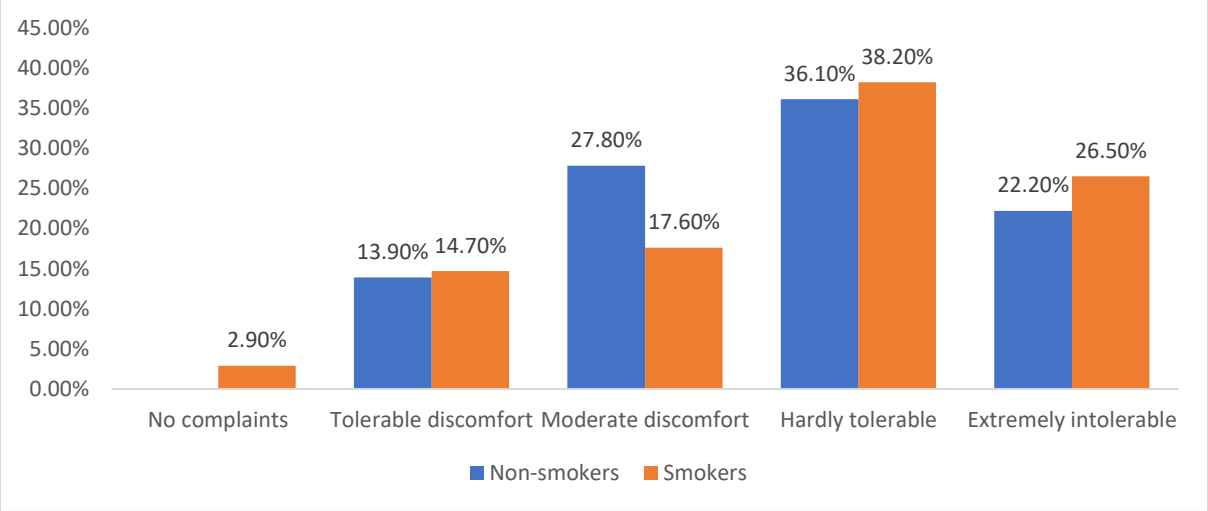


Fig. 25. Evaluation of patient condition in the postoperative period before packing removal based on smoking status

In this table, (table 6) the condition of patients during the postoperative period before packing removal is categorized by the type of intranasal packing used. A significant difference in discomfort levels across the three groups was identified (**$p<0.05$**). This suggests that the type of intranasal packing has an impact on patient-reported comfort during the postoperative recovery phase.

			Group		
			Sutures Splints Gauze Packing – **Group 1**	Sutures Splints PVA Packing – **Group 3**	No Sutures, Splints Gauze Packing – **Group 4**
Evaluation before Packing Removal	No Complaints	Count	0	0	1
		% within Group	0,0%	0,0%	5,6%
	Mild Discomfort	Count	3	2	5
		% within Group	9,7%	9,5%	27,8%
	Moderate Discomfort	Count	10	3	3
		% within Group	32,3%	14,3%	16,7%
	Severe Discomfort	Count	9	10	7
		% within Group	29,0%	47,6%	38,9%
	Extreme Discomfort	Count	9	6	2
		% within Group	29,0%	28,6%	11,1%
Total		Count	31	21	18
		% within Group	100,0%	100,0%	100,0%

Table 6. Evaluation of patient condition in the postoperative period before packing removal based on type of intranasal packing

A moderate correlation (**r=0.426; p=0.001**) was observed between discomfort experienced in the postoperative period before packing removal and the pain experienced during the removal process. This finding indicates that:

- **Severe discomfort** before removal correlates with **severe pain** during the removal process.
- The greater the discomfort experienced prior to removal, the greater the intensity of pain reported during the packing removal.

This relationship underscores the interconnectedness of pre-removal discomfort and removal pain (**Table 7**).

			Evaluation while Packing Removal				
			Mild Discomfort	Mild Pain	Moderate Pain	Severe Pain	Extreme Pain
Evaluation before Packing Removal	No Complaints	Count	1	0	0	0	0
		% within Evaluation while Packing Removal	14,3%	0,0%	0,0%	0,0%	0,0%
	Mild Discomfort	Count	4	2	2	1	1
		% within Evaluation while Packing Removal	57,1%	11,1%	5,7%	12,5%	50,0%
	Moderate Discomfort	Count	1	8	6	1	0
		% within Evaluation while Packing Removal	14,3%	44,4%	17,1%	12,5%	0,0%
	Severe Discomfort	Count	0	8	16	2	0
		% within Evaluation while Packing Removal	0,0%	44,4%	45,7%	25,0%	0,0%
	Extreme Discomfort	Count	1	0	11	4	1
		% within Evaluation while Packing Removal	14,3%	0,0%	31,4%	50,0%	50,0%
Total		Count	7	18	35	8	2
		% within Evaluation while Packing Removal	100,0%	100,0%	100,0%	100,0%	100,0%

Table 7. Correlation between discomfort in the postoperative period before packing removal and pain during packing removal

A more detailed analysis revealed gender-specific differences in the correlation between discomfort in the postoperative period before packing removal and pain during its removal:

- Among **men**, the correlation was **moderate and directly proportional** (**r=0.357; p=0.017**).
- Among **women**, the correlation was **strong** (**r=0.594; p=0.001**).

This indicates that women are more sensitive and have a **lower pain threshold** compared to men.

The evaluation of discomfort levels in the postoperative period before splint removal showed that the majority of patients (**59.2%; n=58**) reported **mild discomfort** (**Fig. 26**).

The **average score** for discomfort was **2.23 ± 0.77**, which is generally categorized as **tolerable discomfort**.

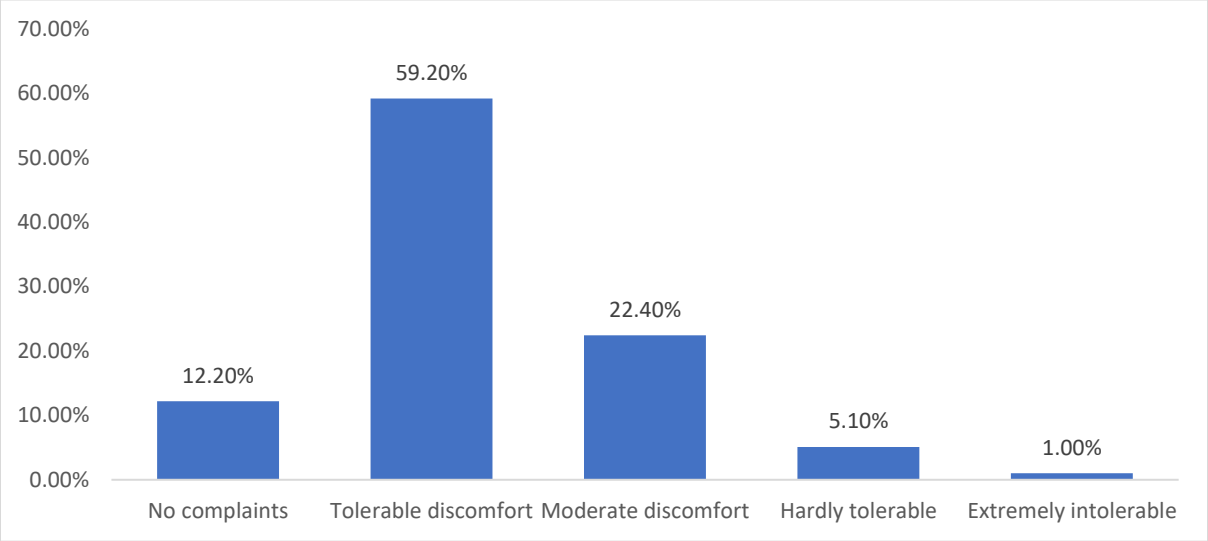


Fig. 26. Evaluation of patients' comfort in the postoperative period before splints removal

No correlation was found between the evaluation of postoperative condition before splint removal and the age of the patients.

However, a **significant difference** was observed based on gender (**p=0.035**), with a **weak correlation** between postoperative condition and gender (**r=0.221; p=0.029**) (**Fig. 27**).

- Among **men**, the average score was **2.11**, indicating **mostly tolerable discomfort**.
- Among **women**, the average score was **2.48**, ranging between **tolerable and moderate discomfort** (**p=0.029**).

These findings suggest that female patients reported slightly higher levels of discomfort compared to male patients.

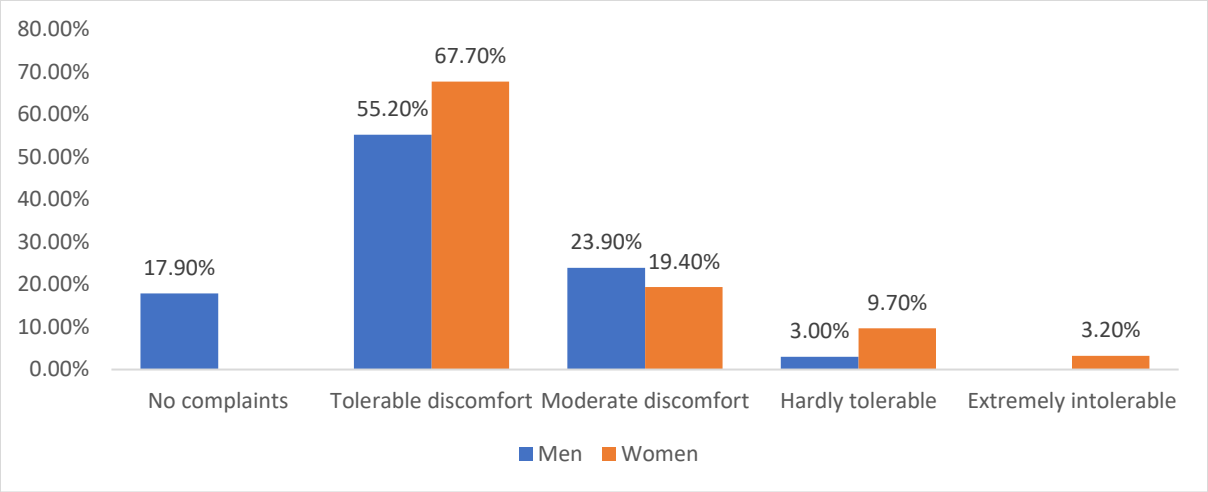


Fig. 27. Evaluation of postoperative comfort before splints removal by gender

The **average scores** of postoperative condition before splint removal showed no significant differences between patients undergoing septoplasty (**2.24**) and those undergoing rhinoseptoplasty (**2.11**).

No significant differences or correlations were found between the evaluation of postoperative condition and the type of surgical intervention. In all four groups, the majority of patients reported **mild discomfort**. (table 8)

			Group			
			Sutures Airway Splints **(Group 1)**	Sutures Splints Gauze Packing **(Group 2)**	Sutures Splints PVA Packing **(Group 3)**	No Sutures, Splints Gauze Packing **(Group 4)**
Evaluation before Splints Removal	No Complaints	Count	4	5	1	2
		% within Group	14,8%	15,6%	4,8%	11,1%
	Mild Discomfort	Count	12	20	13	13
		% within Group	44,4%	62,5%	61,9%	72,2%
	Moderate Discomfort	Count	10	5	4	3
		% within Group	37,0%	15,6%	19,0%	16,7%
	Severe Discomfort	Count	1	1	3	0
		% within Group	3,7%	3,1%	14,3%	0,0%
	Extreme Discomfort	Count	0	1	0	0
		% within Group	0,0%	3,1%	0,0%	0,0%
Total		Count	27	32	21	18
		% within Group	100,0%	100,0%	100,0%	100,0%

Table 8. Evaluation of postoperative comfort before splints removal across groups

No significant difference was observed in the postoperative condition before splint removal between patients with and without hypertension. The average scores were **2.18** for patients with hypertension and **2.24** for those without hypertension (**p>0.05**) (**Fig. 28**).

Similarly, no significant difference was found in the postoperative condition before splint removal between patients with and without diabetes. The average scores were **2.50** for patients with diabetes and **2.22** for those without diabetes.

Among patients with diabetes, **75%** reported **tolerable discomfort**, compared to **58.5%** of patients without diabetes (**Fig. 29**).

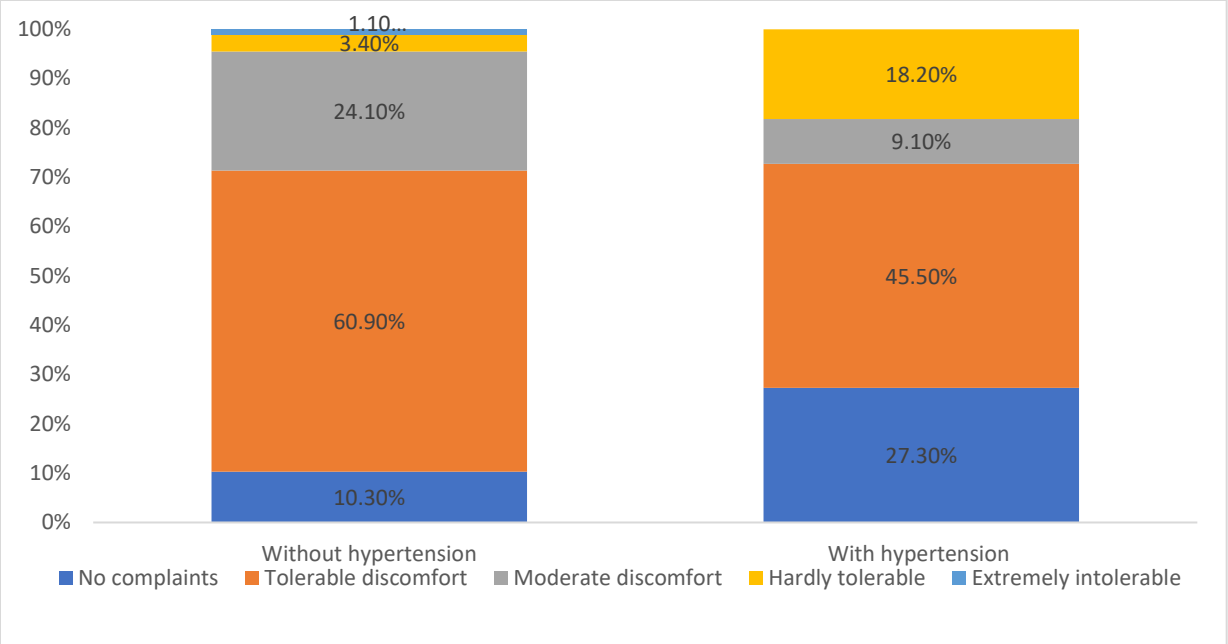


Fig. 28. Distribution of patients by hypertension status and postoperative condition before splints removal

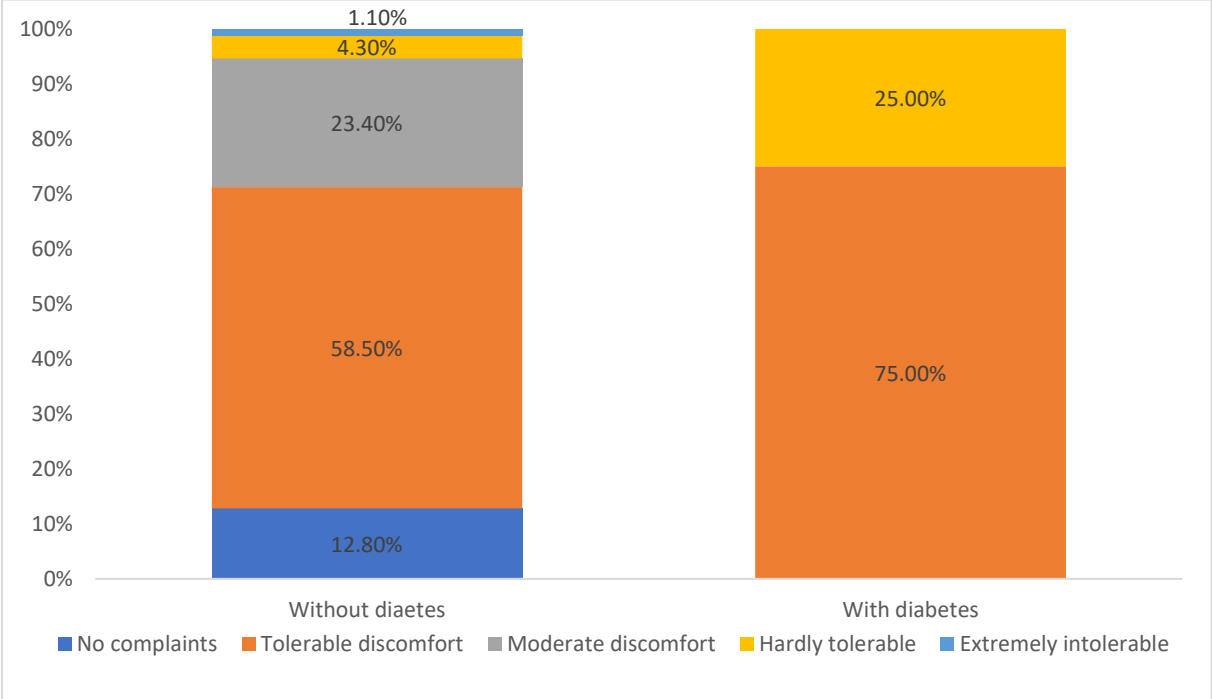


Fig. 29. Distribution of patients by diabetes status and postoperative condition before splints removal

No significant difference was observed in the postoperative condition before splint removal between smokers and non-smokers.

- The **average score** for non-smokers was **2.30**, while for smokers, it was **2.14** (**p>0.05**).
- In both groups, the majority of patients reported experiencing **tolerable discomfort** (**Fig. 30**).

This indicates that smoking status does not significantly impact the level of discomfort experienced in the postoperative period before splint removal.

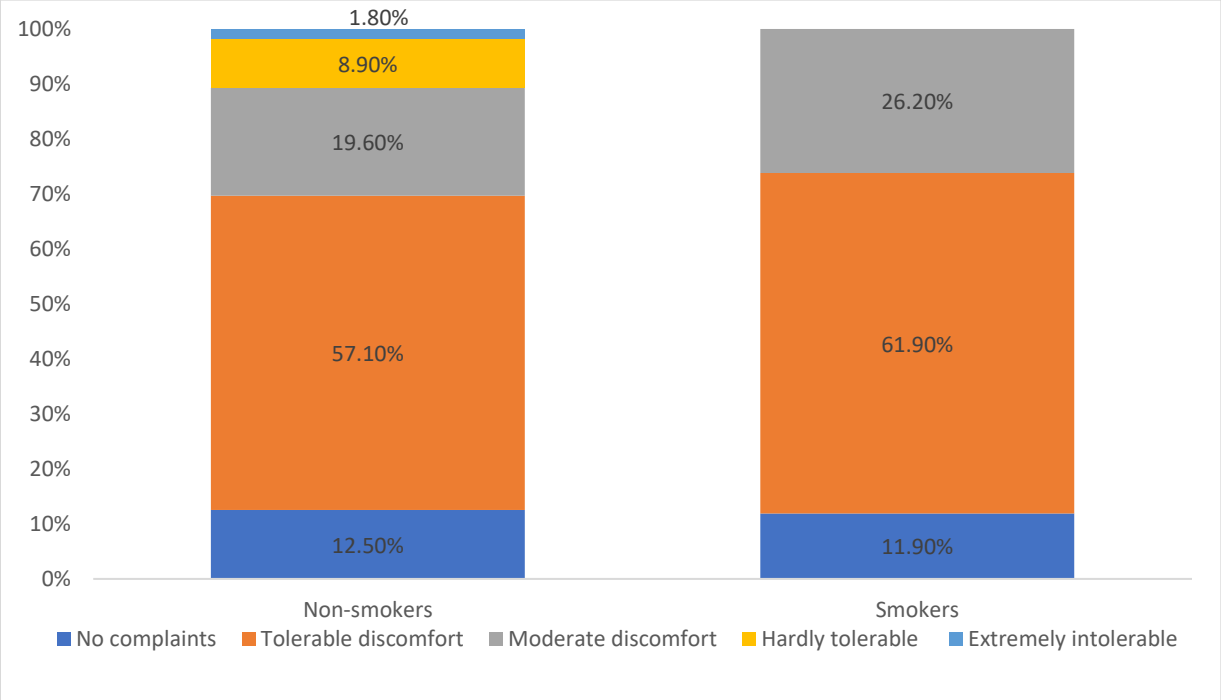


Fig. 30. Distribution of patients by smoking status and postoperative condition before splints removal

The **average pain score** during splint removal was **1.42 ± 0.61**, which is categorized as **mild discomfort**.

- More than half of the patients (**62.2%; n=61**) reported experiencing **mild discomfort** during splint removal.
- Only **1.0% (n=1)** of patients reported experiencing **severe pain** (**Fig. 31**).

While no significant difference was observed in the average pain score between patients undergoing different surgeries, patients who had rhinoseptoplasty reported a slightly higher average pain score (**1.55**) compared to those who had septoplasty (**1.41**).

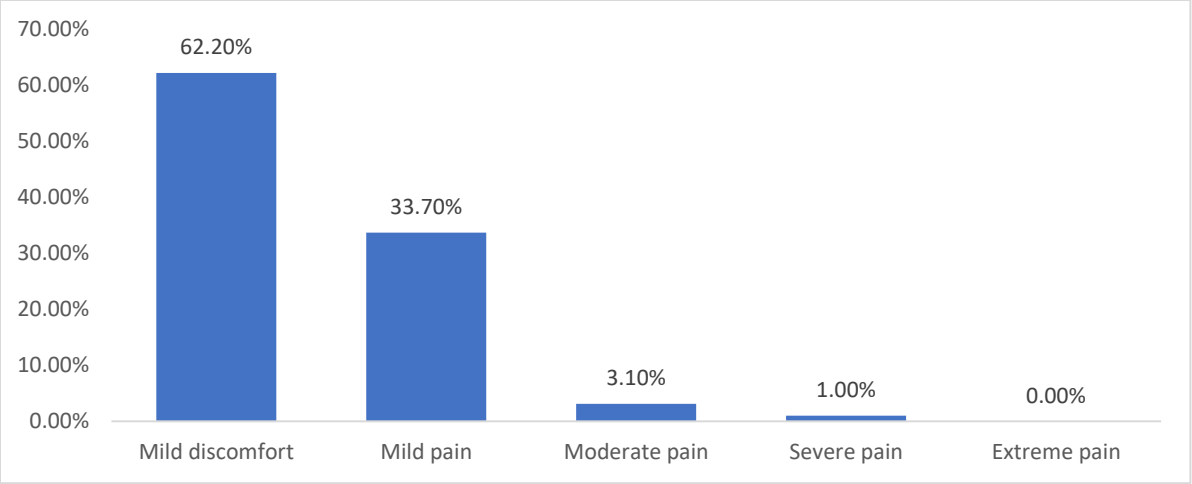


Fig. 31. Pain during splints removal

No correlation was found between the patients' age and the pain experienced during splint removal.

The **average pain score** was higher among women (**1.58**), which varied between **mild discomfort and slight pain**, compared to men, whose average score was **1.36**, indicating **mild discomfort**.

Gender differences were evident:

- **70.1% of men** reported only **mild discomfort**.
- **51.6% of women** reported experiencing **slight pain** (**Fig. 32**).

These findings suggest that women may perceive splint removal as slightly more painful compared to men.

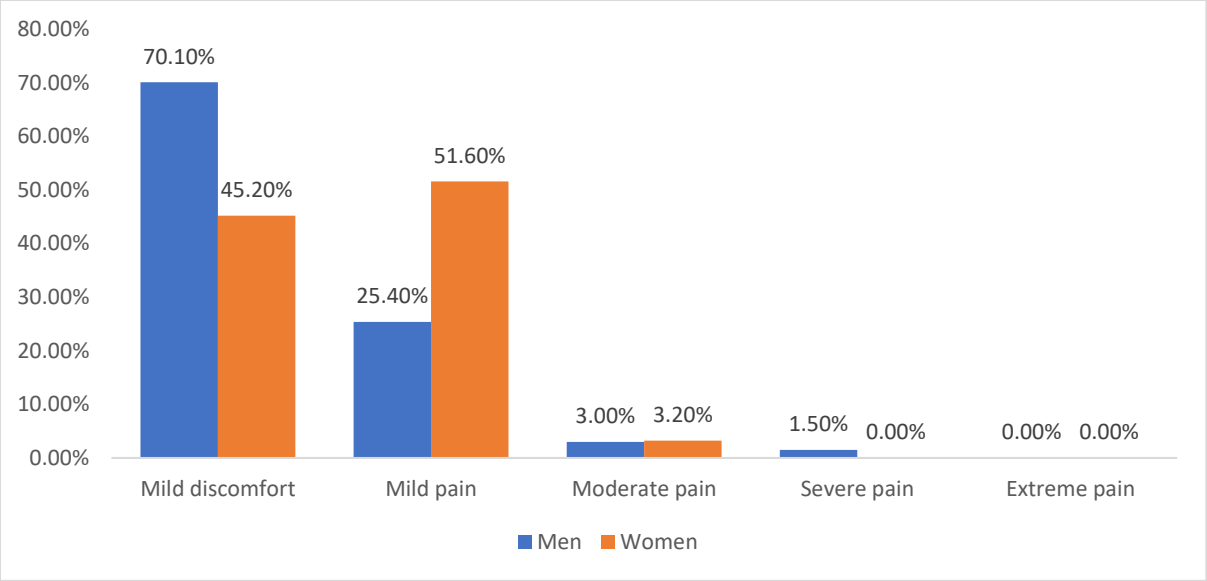


Fig. 32. Pain during splints removal by gender

No significant difference was found in pain levels during splint removal between patients with and without hypertension. The **average pain scores** were:

- **1.43** for patients with hypertension.
- **1.45** for patients without hypertension (**p>0.05**).

In both groups, the majority of patients reported **mild discomfort** during splint removal (**Fig. 33**).

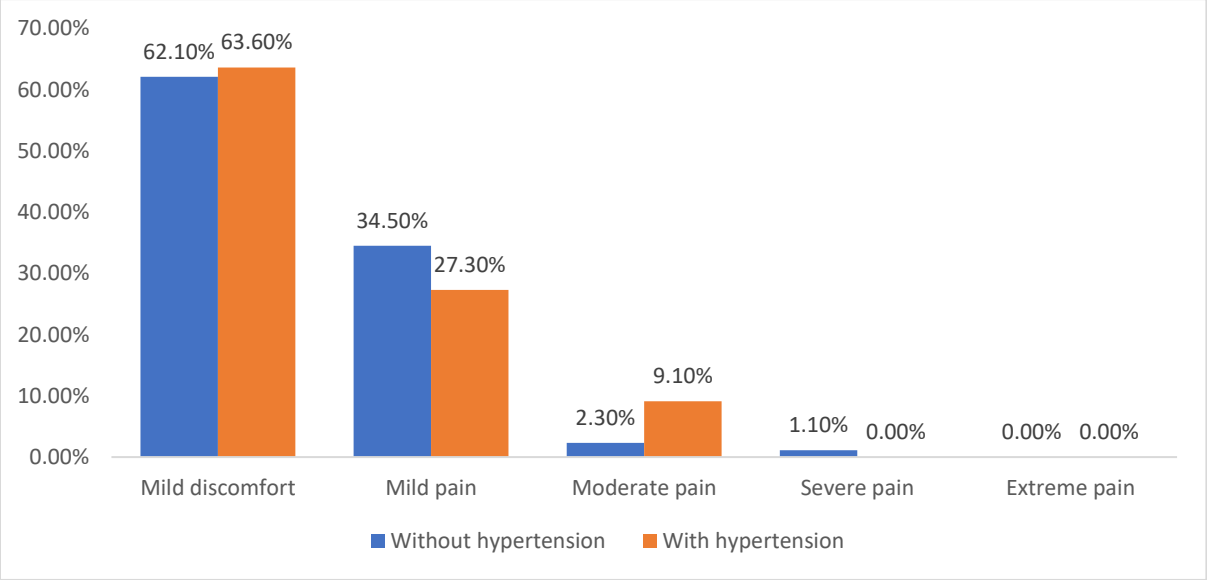


Fig. 33. Pain during splint removal by hypertension status

No significant difference was observed in pain intensity during splint removal between patients with and without diabetes. The **average pain scores** were:

- **1.50** for patients with diabetes.
- **1.42** for patients without diabetes (**p>0.05**).

Among **patients with diabetes**:

- **50%** reported **mild discomfort**.
- **50%** reported **slight pain**.

Among **patients without diabetes**:

- **62.8%** reported **mild discomfort** (**Fig. 34**).

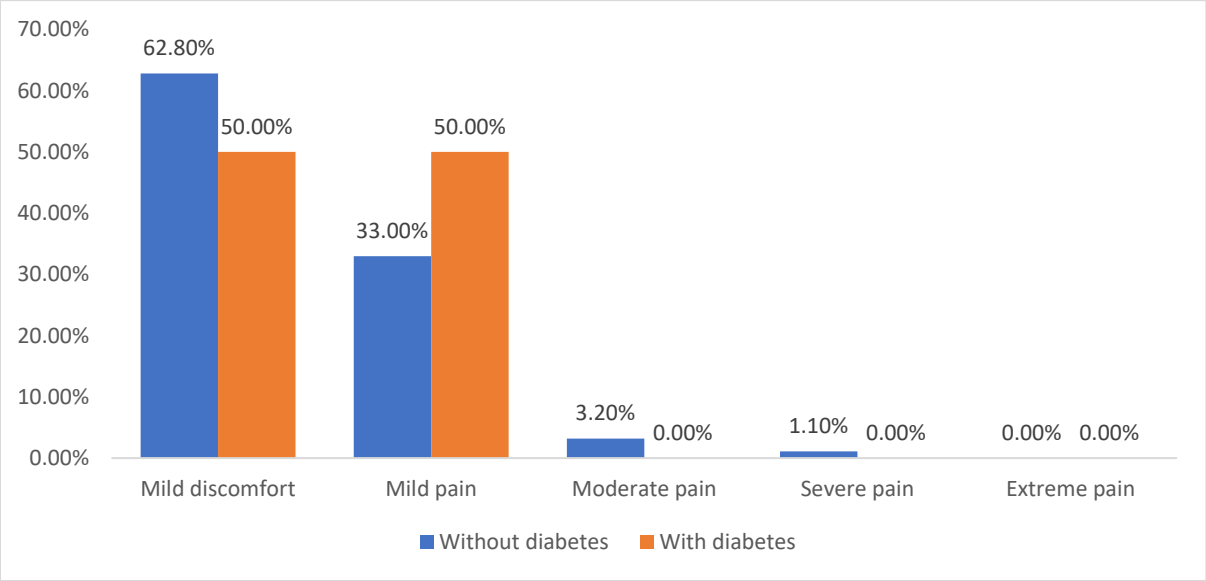


Fig. 34. Pain during splints removal by diabetes status

All patients with asthma reported experiencing **mild discomfort** during splint removal.

Smoking status does not appear to influence pain levels during splint removal. The **average pain score** was identical for both smokers and non-smokers at **1.43**.

- A majority of patients in both groups reported **mild discomfort**.
- Only **one smoker** reported experiencing **severe pain** during splint removal (**Fig. 35**).

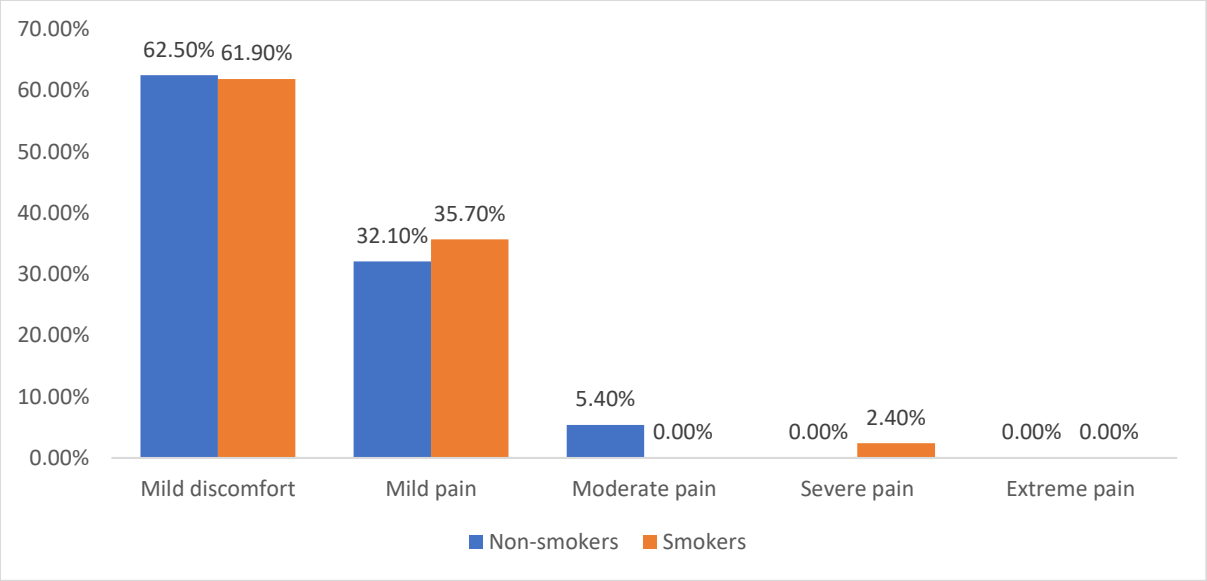


Fig. 35. Pain during splints removal by smoking status

No significant differences or correlations were found between pain during splint removal and the type of study group (**Table 9**). Across all four groups, the majority of patients reported **mild discomfort**.

A moderate correlation (**r=0.420; p<0.001**) was identified between discomfort in the postoperative period before splint removal and pain during its removal. This indicates that:

- **Mild discomfort** before splint removal correlates with **mild pain** during the removal process.
- The less discomfort experienced before removal, the less pain reported during the removal. (**Table 10**).

A more detailed analysis revealed gender-specific differences:

- Among **men**, there was a **moderate, directly proportional correlation** (**r=0.469; p<0.001**) between discomfort before splint removal and pain during the removal process.
- Among **women**, no similar correlation was identified.

These findings suggest that men's perception of pain during splint removal is more closely tied to their level of discomfort in the postoperative period before removal, while this relationship does not hold for women.

			Group			
			Sutures Airway Splints	Sutures Splints Gauze Packing	Sutures Splints PVA Packing	No Sutures, Splints Gauze Packing
Evaluation while Splints Removal	Mild Discomfort	Count	16	21	10	14
		% within Group	59,3%	65,6%	47,6%	77,8%
	Mild Pain	Count	8	11	10	4
		% within Group	29,6%	34,4%	47,6%	22,2%
	Moderate Pain	Count	2	0	1	0
		% within Group	7,4%	0,0%	4,8%	0,0%
	Severe Pain	Count	1	0	0	0
		% within Group	3,7%	0,0%	0,0%	0,0%
Total		Count	27	32	21	18
		% within Group	100,0%	100,0%	100,0%	100,0%

Table 9. Pain during splints removal by study group

			Evaluation while Splints Removal			
			Mild Discomfort	Mild Pain	Moderate Pain	Severe Pain
Evaluation before Splints Removal	No Complaints	Count	11	1	0	0
		% within Evaluation while Splints Removal	18,0%	3,0%	0,0%	0,0%
	Mild Discomfort	Count	41	17	0	0
		% within Evaluation while Splints Removal	67,2%	51,5%	0,0%	0,0%
	Moderate Discomfort	Count	6	13	2	1
		% within Evaluation while Splints Removal	9,8%	39,4%	66,7%	100,0%
	Severe Discomfort	Count	2	2	1	0
		% within Evaluation while Splints Removal	3,3%	6,1%	33,3%	0,0%
	Extreme Discomfort	Count	1	0	0	0
		% within Evaluation while Splints Removal	1,6%	0,0%	0,0%	0,0%
Total		Count	61	33	3	1
		% within Evaluation while Splints Removal	100,0%	100,0%	100,0%	100,0%

Table 10. Correlation between discomfort in postoperative period before splints removal and pain during splints removal

For all patients treated with packing, the packing was removed after 24 hours. Bleeding during removal was observed as follows:

- **Mild oozing**: **60.0%** (n=42).
- **No bleeding**: **30.0%** (n=21).
- **Active bleeding**: **10.0%** (n=7).

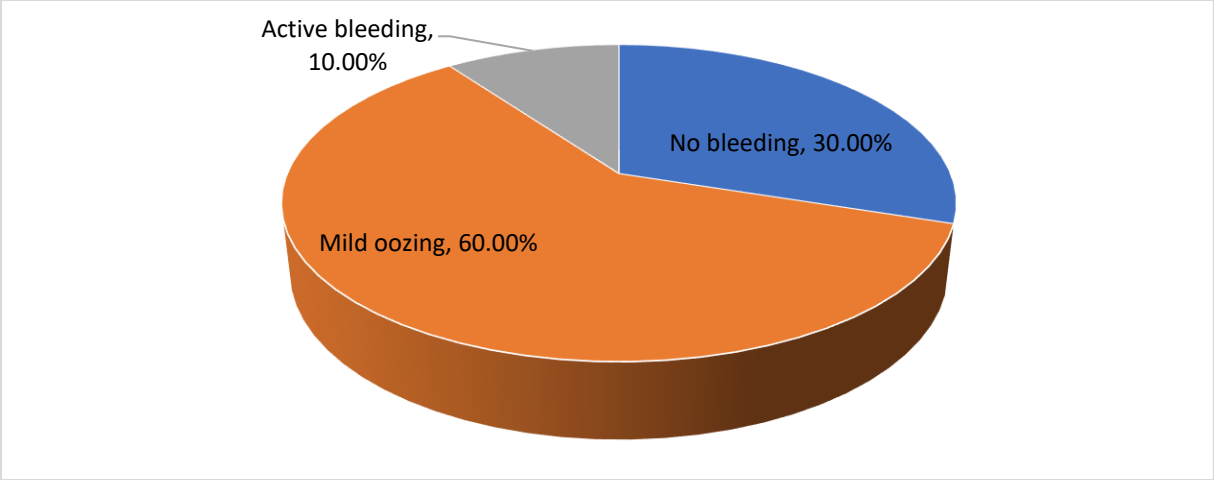


Fig. 36 Distribution of bleeding intensity during packing removal

No significant relationship was identified between the type of surgical intervention and the bleeding observed during packing removal. Additionally, no correlation was found between bleeding and the level of discomfort experienced in the postoperative period or the pain during packing removal.

However, patients with hypertension demonstrated a **higher likelihood of active bleeding** during packing removal (**Fig. 37**).

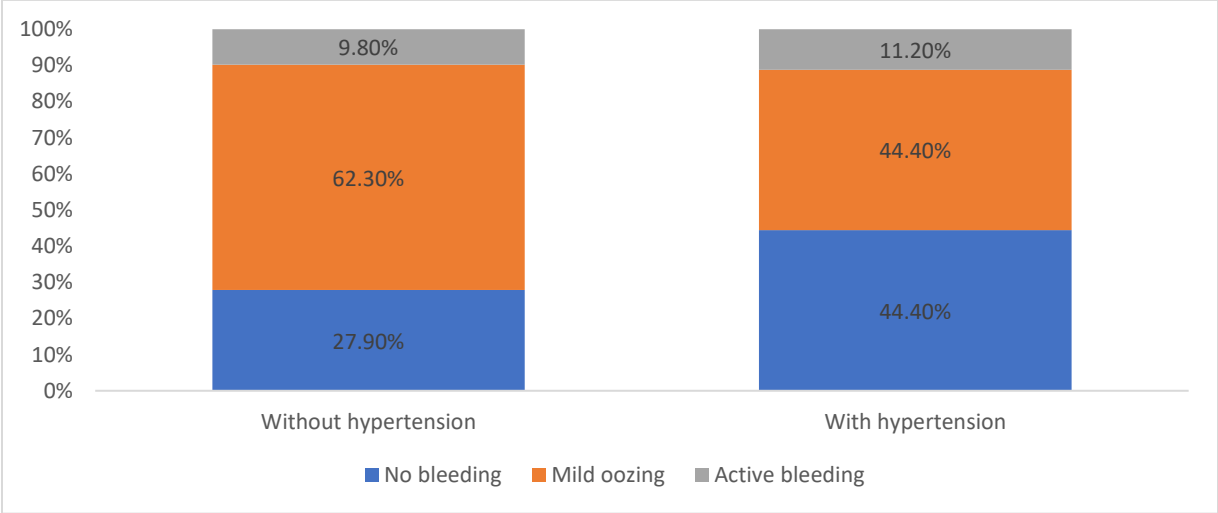


Fig. 37. Bleeding during packing removal by hypertension status

A **moderate correlation** (**r=0.330; p=0.005**) was identified between bleeding during packing removal and smoking status:

- **70% of smokers** reported **mild oozing**.
- **14.7% of smokers** reported **active bleeding** during the procedure (**p=0.020**) (**Fig. 38**).

These findings suggest that smoking is associated with an increased risk of bleeding during packing removal.

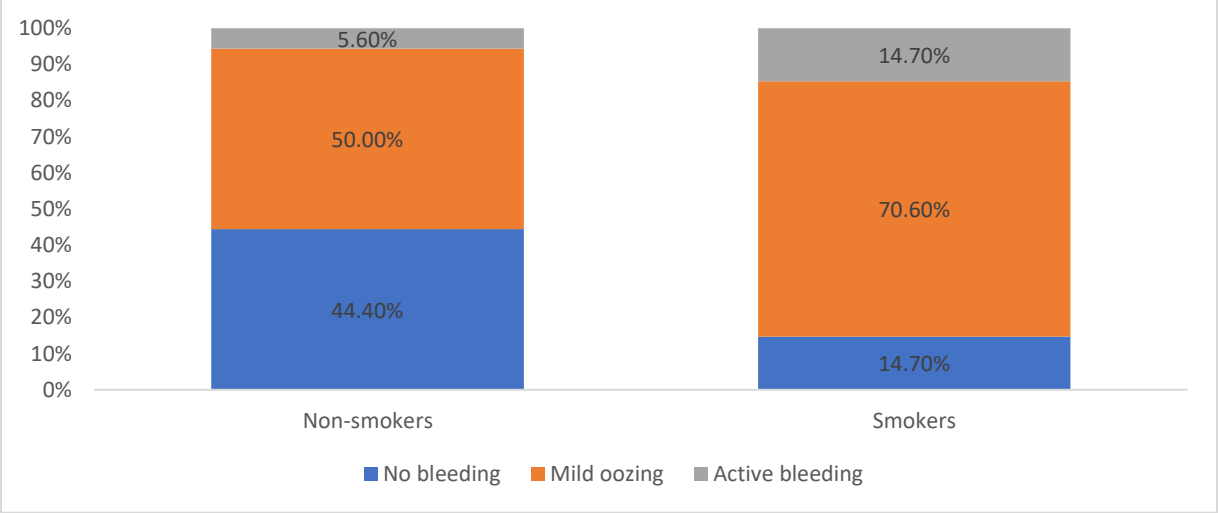


Fig. 38. Bleeding during packing removal by smoking status

The study results showed a **moderate correlation** between septoplasty and bleeding during packing removal (**r=0.379; p=0.001**).

- Among patients who underwent septoplasty:
  - **65.1%** reported **mild oozing**.
  - **11.1%** reported **active bleeding** during the procedure (**p=0.003**) (**Fig. 39**).

These findings indicate that septoplasty is associated with an increased likelihood of bleeding during packing removal.

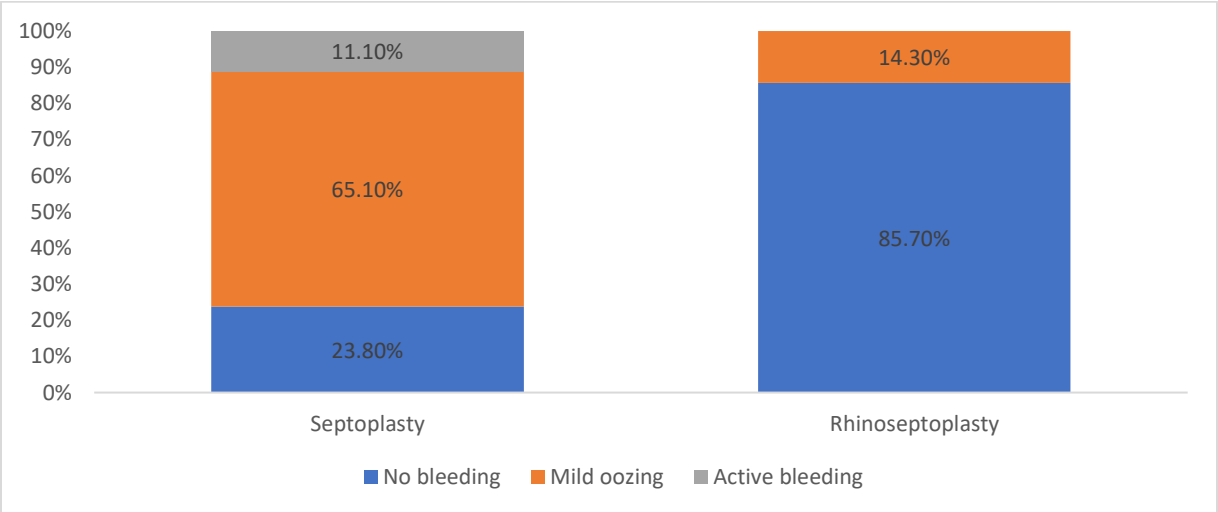


Fig. 39. Bleeding during packing removal by type of surgery

Splints were removed:

- **After the 7th day** in **82.7% (n=81)** of cases.
- **After the 10th day** in **17.3% (n=17)** of cases.

No correlation was found between the timing of splint removal and:

- Discomfort in the postoperative period before removal.
- Pain during removal.
- Patient characteristics such as gender, age, type of surgical intervention, or comorbidities.

The analysis revealed a significant difference in the timing of splint removal based on smoking status (**p=0.012**):

- **28.6% of smokers** had their splints removed after the 10th day.
- Only **8.9% of non-smokers** had splints removed after the 10th day (**Fig. 40**).

The likelihood of splints being removed on the 10th day was **4 times higher** in smokers compared to non-smokers (**OR=4.08 (1.309–12.713); p=0.011**).

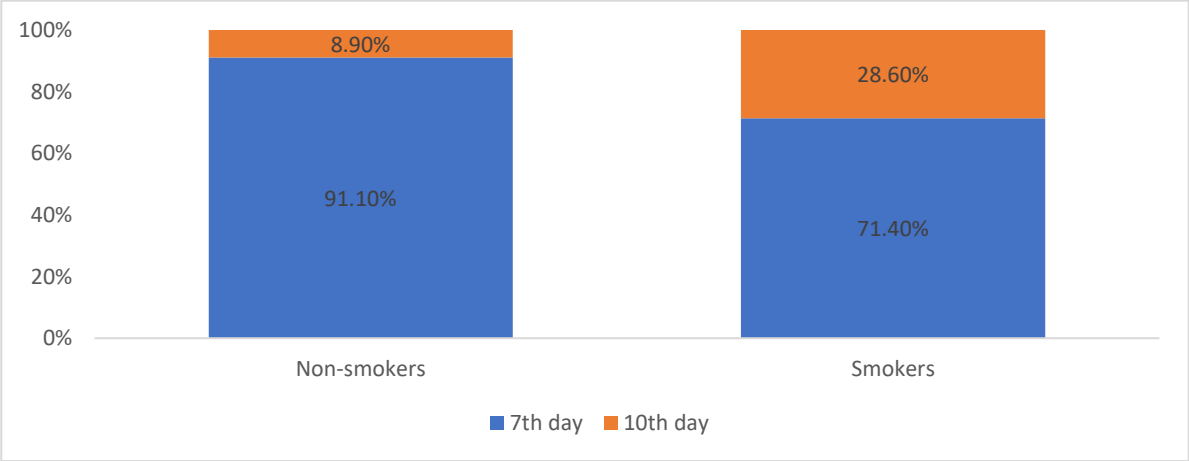


Fig. 40. Timing of splints removal by smoking status

Smoking was found to significantly influence the timing of splint removal, with smokers being **4 times more likely** to have splints removed on the 10th day compared to non-smokers (**OR=4.08 (1.309–12.713); p=0.011**).

A significant difference was observed in the timing of splint removal based on whether or not transseptal sutures were used:

- For patients **without sutures**, all splints were removed on the **7th day**.
- For **94.4% of patients** treated with transseptal sutures, splints were removed after the **10th day** (**p<0.001**).

A **strong correlation** was identified between treatment with sutures and the timing of splint removal (**r=0.966; p<0.001**).

A detailed analysis revealed a **strong correlation** (**r=0.537; p<0.001**) between postoperative discomfort before packing removal and splint removal:

- Patients who experienced discomfort before packing removal were also likely to report discomfort before splint removal.

This finding highlights the interconnected nature of patient discomfort during postoperative recovery (**Fig. 41**).

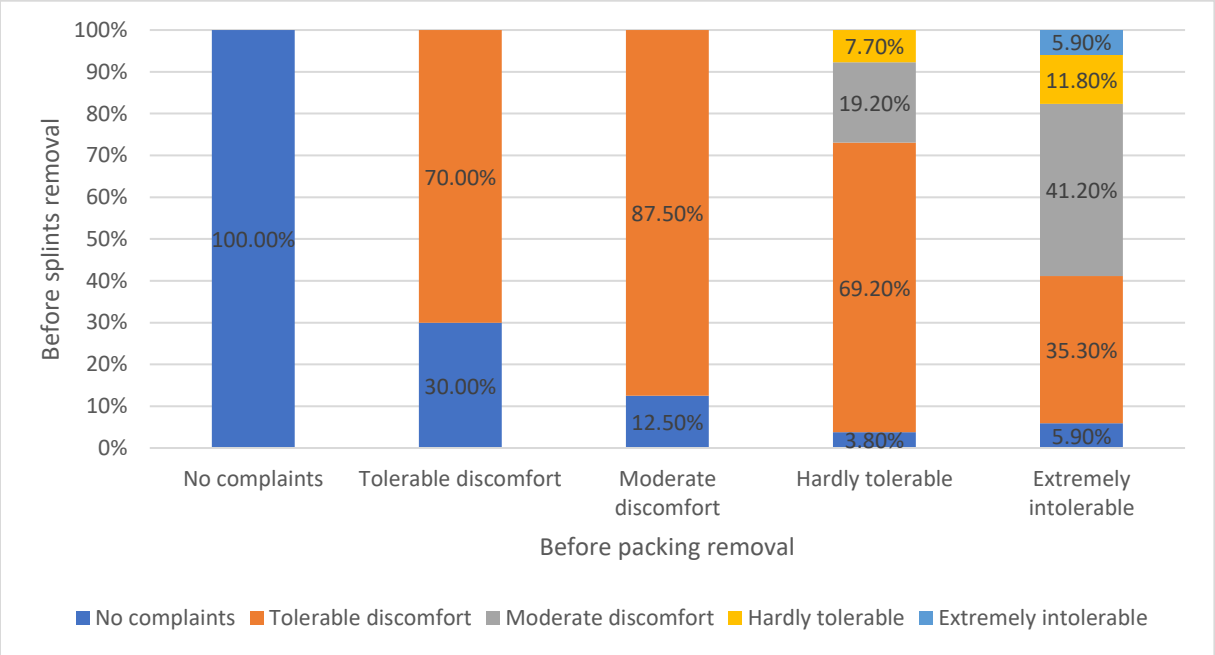


Fig. 41. Correlation between postoperative comfort before packing and splint removal

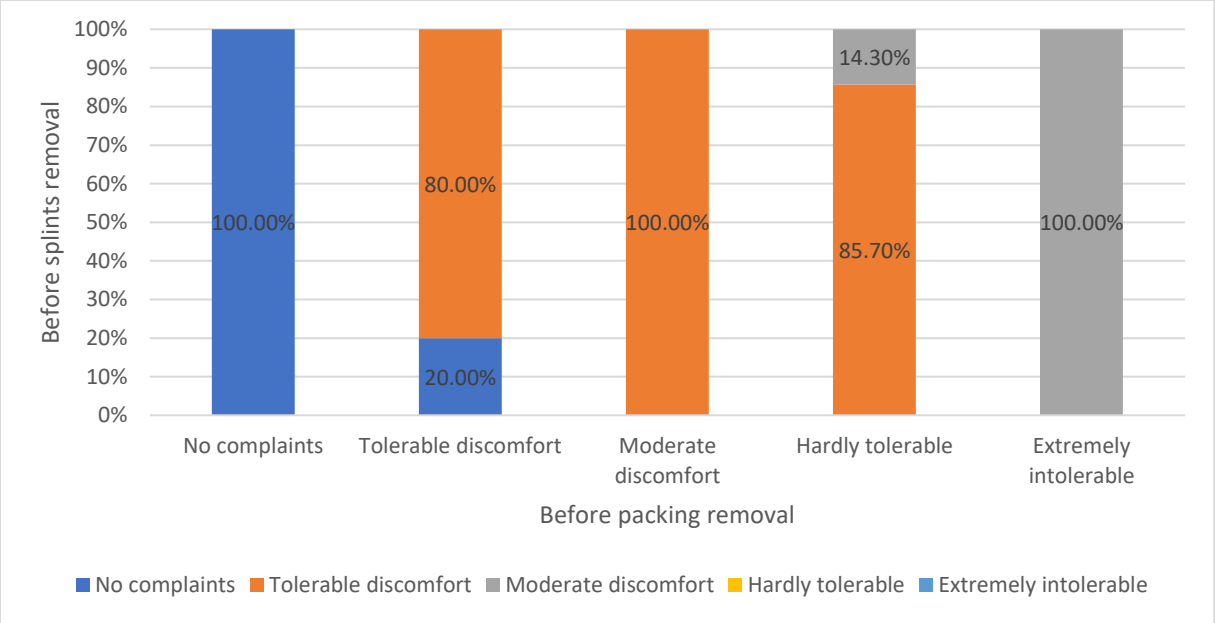


Fig. 42. Correlation between postoperative condition before packing and splint removal in Group 4

The strongest correlation regarding postoperative condition before packing and splint removal was observed in **Group 4**, with a **very strong relationship** (**r=0.728; p=0.001**). (Fig. 42)This demonstrates a significant overlap in patient experiences of discomfort in the two postoperative stages.

- In **Group 1**, a **moderate correlation** (**r=0.475; p=0.007**) was observed, indicating a noticeable but less pronounced relationship between discomfort before packing and splint removal. (Fig. 43)
- A similar **moderate correlation** was also identified in **Group 3**, as shown in **Fig. 44**.

These findings suggest that while discomfort levels in the two stages are connected across all groups, the strength of this connection varies, being strongest in **Group 4** and moderate in **Groups 1 and 3**.

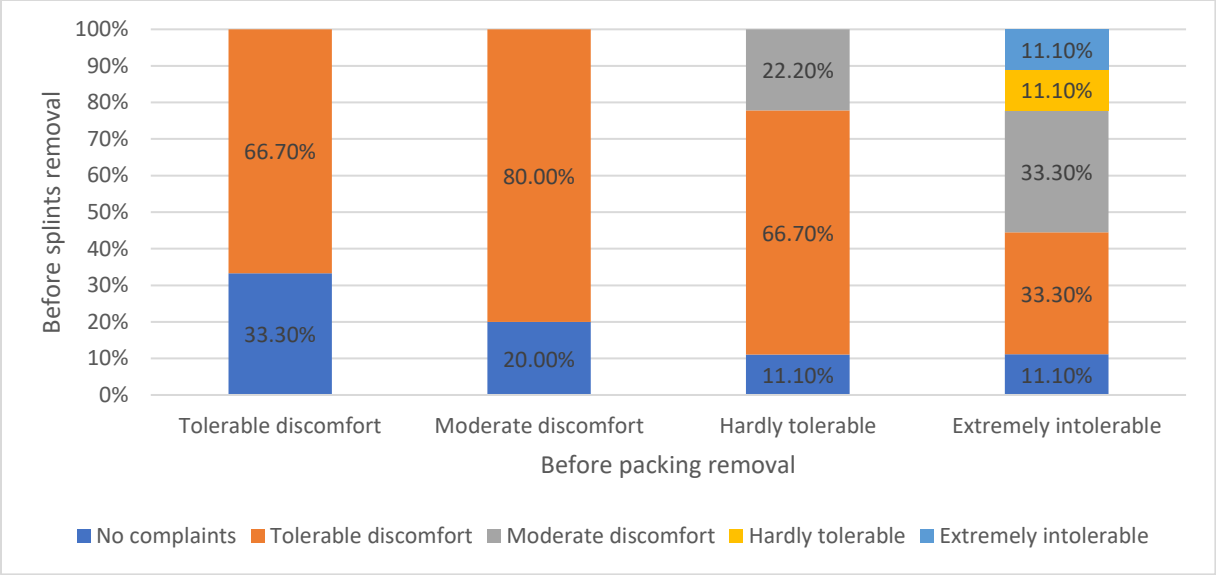


Fig. 43. Correlation between postoperative condition before packing and splint removal in Group 1

Fig. 44. Correlation between postoperative condition before packing and splint removal in Group 3

A comparative analysis of the postoperative condition of patients before packing and splint removal revealed a **significant difference** (**p<0.001**). Patients treated with **splints only** experienced **less discomfort** compared to those treated with both **packing and splints** (**Fig. 45**).

- **Average Condition Score Before Packing Removal**:
  - **Patients treated with packing**: **3.62**, indicating **moderate to severely tolerable discomfort**.

- **Patients treated with splints only**: **2.16**, classified as **tolerable discomfort** (**p<0.01**).

This comparison underscores that the use of splints without packing results in a more comfortable postoperative experience.

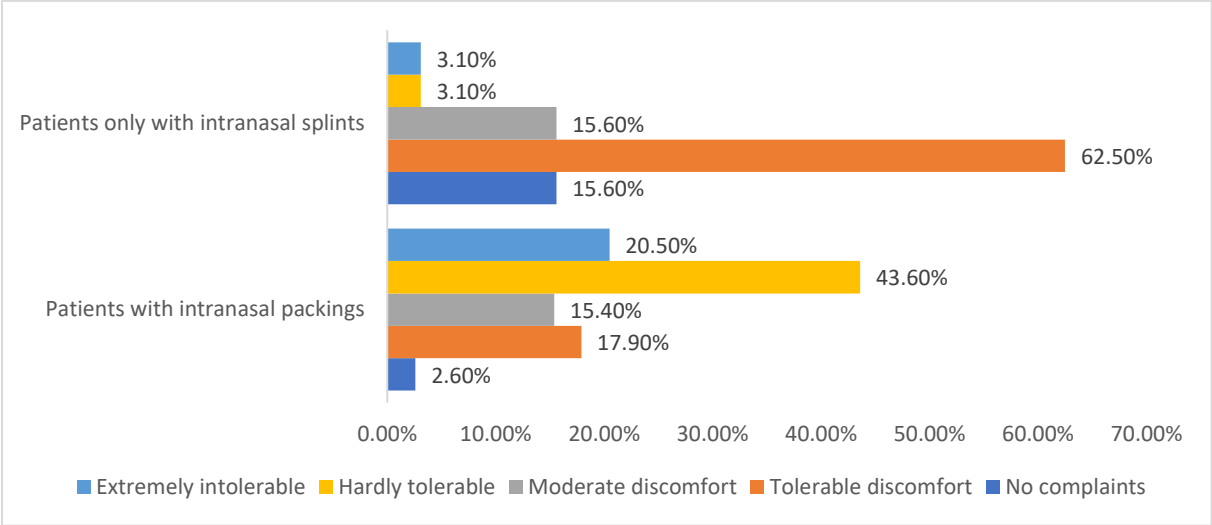


Fig. 45. Comparative analysis of postoperative condition before packing and splint removal

Patients treated with **packing and splints** reported significantly more discomfort (**average score: 3.62**, indicating **moderate to severely tolerable discomfort**) compared to those treated with **splints only**, who had an average score of **2.16**, categorized as **tolerable discomfort** (**p<0.01**). (Fig. 46)

A comparative analysis of pain during the removal of packing and splints also revealed a **significant difference** among patients (**p<0.001**).

- Patients treated with **packing** reported **greater pain** compared to those treated with **splints only**:
  - **Average pain score for packing removal**: **2.87**, indicating **moderate pain**.
  - **Average pain score for splint removal**: **1.34**, categorized as **mild discomfort**.

These results highlight that patients treated with splints alone experience significantly less pain during the removal process compared to those treated with packing (**p<0.01**).

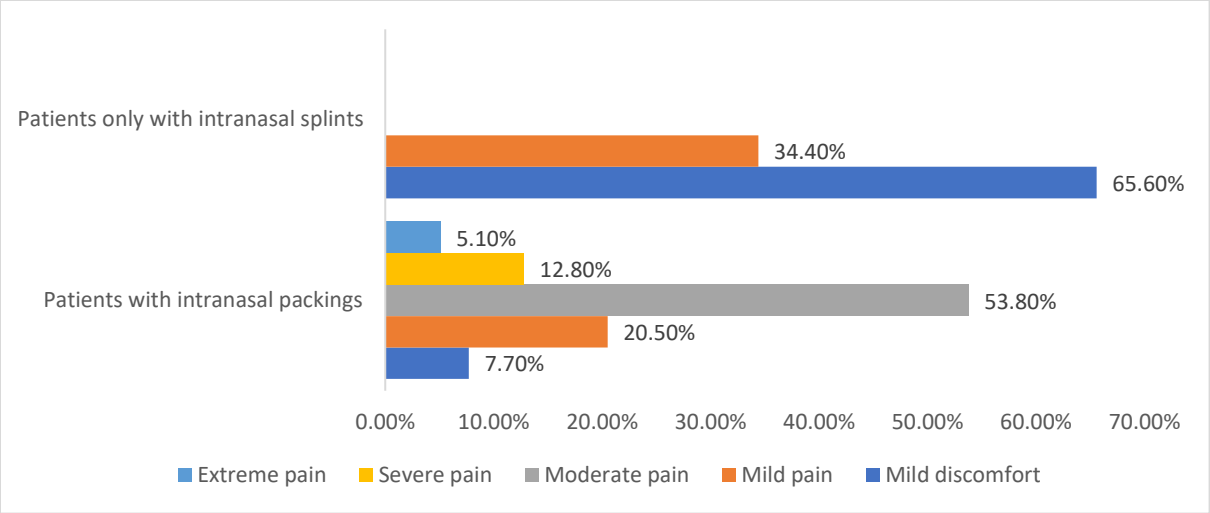


Fig. 46. Comparative analysis of pain during packing and splint removal

The analysis revealed a **significant difference** (**p=0.028**) in the postoperative condition before packing removal between patients treated with and without sutures:

- **Patients without sutures** reported **severely tolerable discomfort**, with an average score of **3.84**.
- **Patients with sutures** reported **moderately tolerable discomfort**, with an average score of **3.22**.

The analysis of postoperative condition before splint removal showed **no significant difference** between patients treated with and without sutures. Both groups reported **tolerable discomfort**:

- **Patients without sutures**: Average score of **2.27**.
- **Patients with sutures**: Average score of **2.05**.

No significant difference was found in postoperative pain during the removal of packing and splints between the two groups:

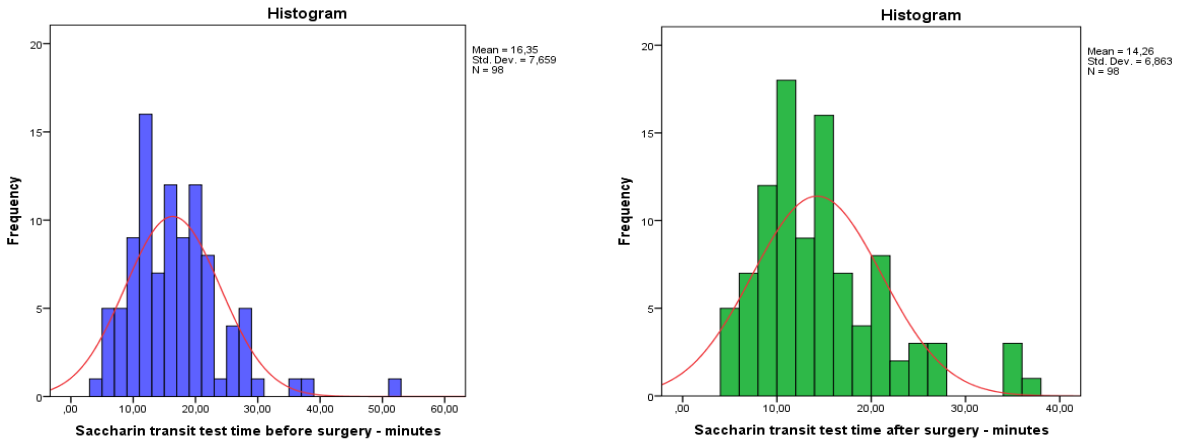
- **Packing Removal**:
  - Patients without sutures reported **moderate pain** (average score **2.69**).
  - Patients with sutures also reported **moderate pain** (average score **2.77**).
- **Splint Removal**:
  - Patients without sutures reported **mild discomfort** (average score **1.47**).
  - Patients with sutures reported **mild discomfort** (average score **1.22**).

3.4. Evaluation of the impact of postoperative intranasal packings and splints on mucociliary clearance using the Saccharin test

The average duration of mucociliary clearance, as measured by the saccharin test:

- **Before surgery**: **16.3 ± 7.6 minutes** (range: 4–52 minutes).
- **After surgery**: **14.3 ± 6.9 minutes** (range: 5–36 minutes).

These results are illustrated in **Fig. 47**, highlighting the improvement in mucociliary clearance following surgery.



Mucociliary clearance before surgery Mucociliary clearance after surgery

Fig. 47. Mucociliary Clearance

No significant differences or correlations were found between mucociliary clearance before and after surgery and the **gender** or **age** of the patients.

Although no significant differences were observed, it was noted that **smoking** tends to **prolong mucociliary clearance** times before surgery (**Fig. 48**).

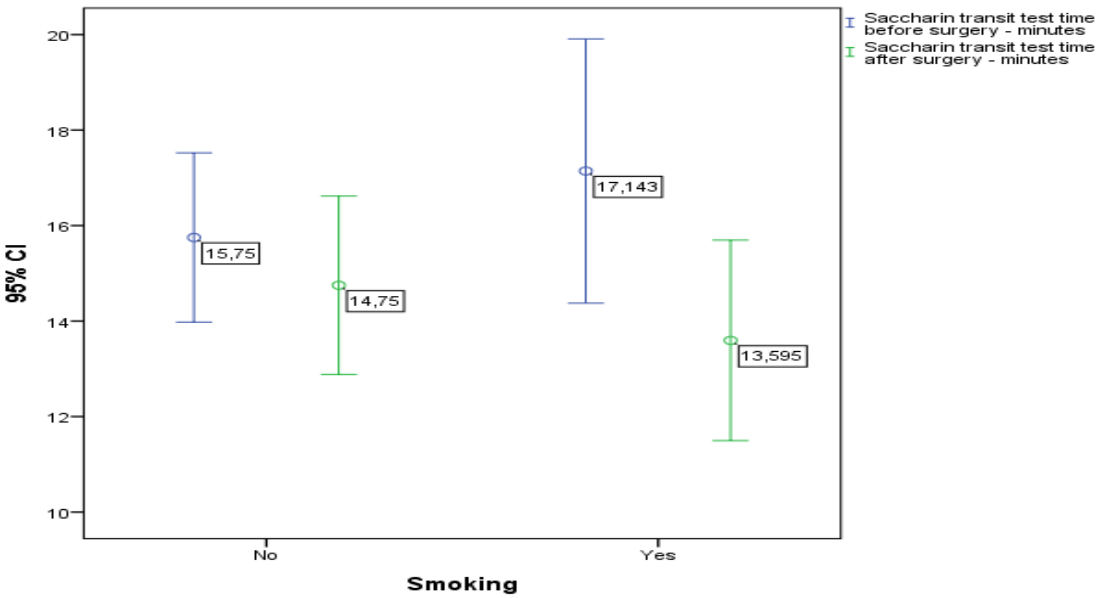


Fig. 48. Mucociliary Clearance and smoking

Although no significant differences were found, it was observed that **rhinoseptoplasty** patients tended to have **shorter mucociliary clearance times** compared to other surgical interventions (**Fig. 49**).

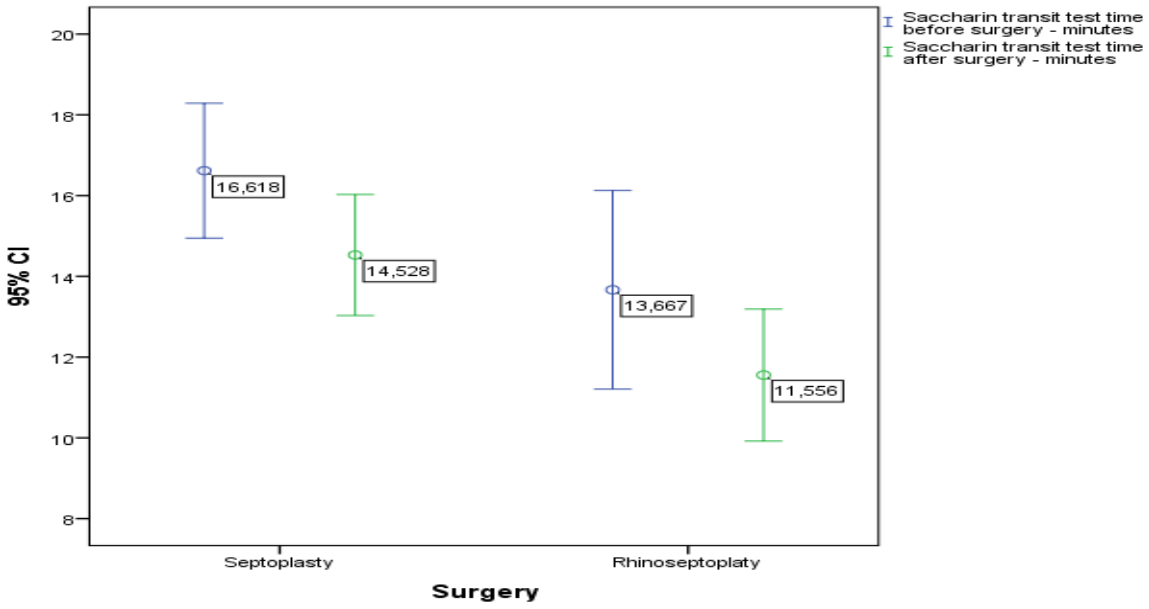


Fig. 49. Mucociliary Clearance by type of surgery

A significant difference (**p<0.05**) in mucociliary clearance before and after surgery was identified based on the type of intervention (**Fig. 50**).

- The most notable improvement was observed in patients treated with **sutures, splints without air channels, and PVA packing**, where mucociliary clearance times decreased from **15.6 minutes before surgery** to **11.76 minutes after surgery**.

This finding highlights the impact of specific surgical techniques and postoperative materials on improving mucociliary clearance.

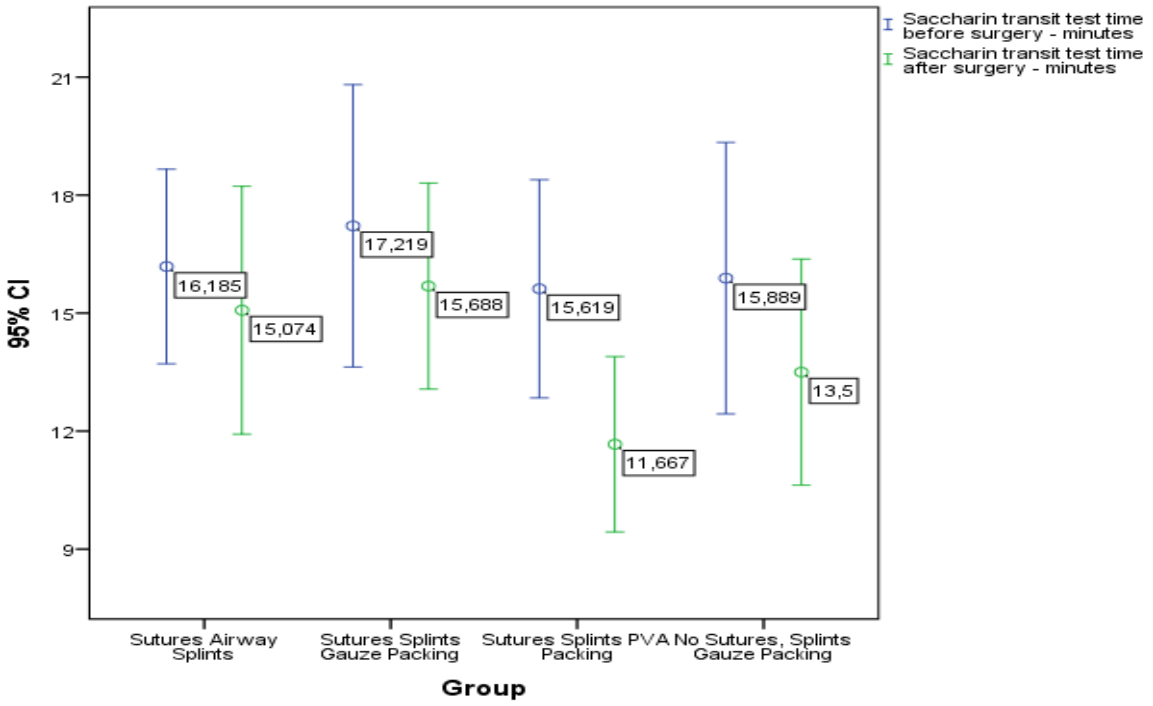


Fig. 50. Mucociliary Clearance by type of intervention

The analysis of the effect of postoperative intranasal packings and splints on mucociliary clearance, considering smoking status, revealed several significant differences (**Fig. 51**):

1. **Non-Smokers**:
    - No significant difference in mucociliary clearance times was observed before and after surgical interventions, except in patients treated with **sutures, splints without air channels, and PVA packing**, where a significant improvement was noted (**p<0.01**).
        - **Before treatment**: **16.1 minutes**.
        - **After treatment**: **12 minutes**.
    - Among patients without sutures but treated with splints and packing, the shortest mucociliary clearance times were recorded (**11.8 minutes before treatment** and **10.8 minutes after treatment**) compared to other groups (**p<0.05**).
2. **Smokers**:
    - Before surgery, smokers demonstrated **prolonged mucociliary clearance times** compared to non-smokers, except for those treated with **sutures, splints without air channels, and PVA packing** (**p<0.05**).
    - After surgical interventions, all smokers showed **significantly shorter mucociliary clearance times** (**p<0.01**), indicating an improvement in nasal function post-surgery.

These findings highlight the notable influence of smoking on mucociliary clearance and the varying effects of specific postoperative interventions.

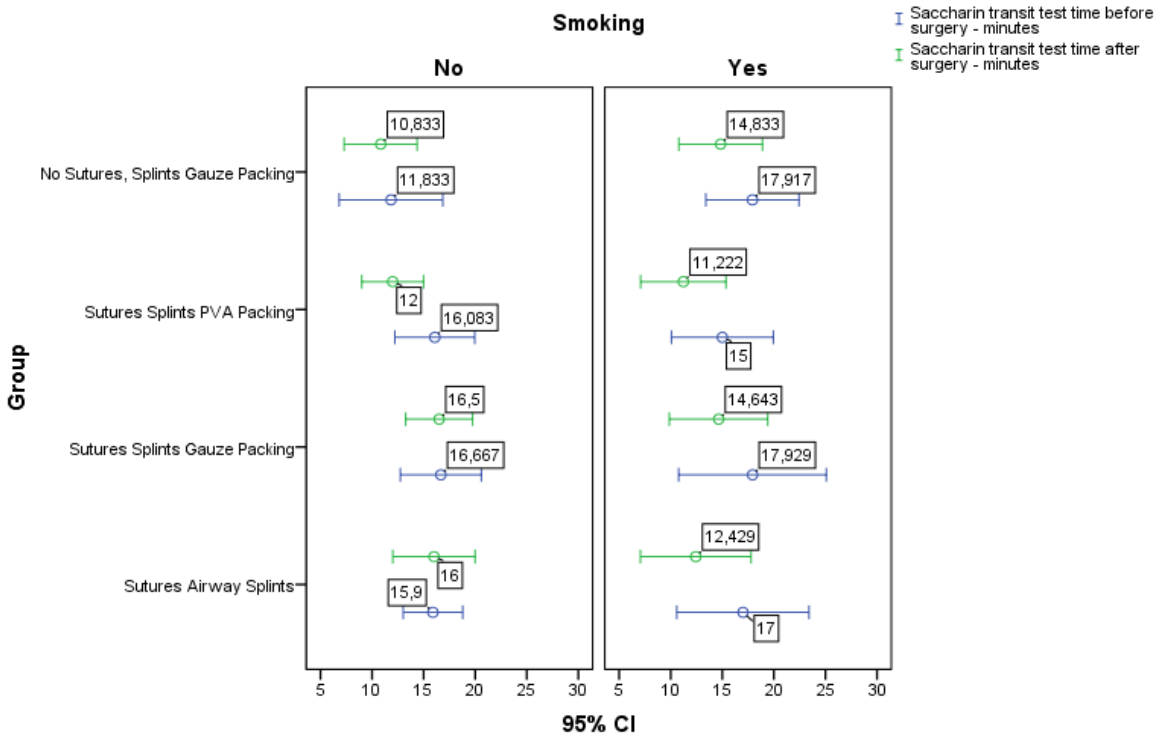


Fig. 51. Mucociliary Clearance by intervention type and smoking status

A significant difference (**p<0.05**) in mucociliary clearance was observed between patients treated with packing and those treated with splints only (**Fig. 52**):

- **Patients treated with splints only** had a **longer mucociliary clearance time** compared to those treated with packing.

For both groups, there was a significant reduction in mucociliary clearance duration post-treatment (**p<0.05**):

- **Before treatment**:
  - Patients with packing: **15.9 minutes**.
  - Patients with splints only: **17.2 minutes**.
- **After treatment**:
  - Both groups experienced reduced clearance times, demonstrating the effectiveness of the interventions.

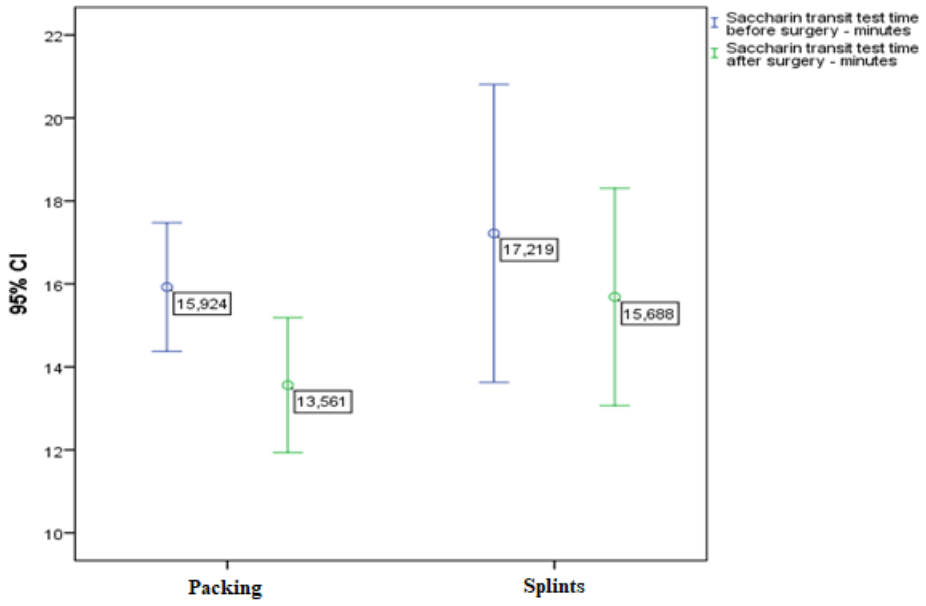


Fig. 52. Mucociliary Clearance by treatment with packing or splints only

An analysis of results based on smoking status revealed:

- **Non-smokers**:
  - For patients treated with **splints only**, there was **no significant change** in mucociliary clearance times.
  - For patients treated with **packing**, mucociliary clearance times significantly decreased from **15.3 minutes to 13.9 minutes** (**$p<0.05$**).
- **Smokers**:
  - Smokers exhibited slightly **prolonged pre-treatment mucociliary clearance times** compared to non-smokers, regardless of whether they were treated with packing or splints.
  - Significant reductions in mucociliary clearance times were observed post-treatment for both treatment types:
    - **Packing group**: Clearance reduced from **16.7 minutes to 13.1 minutes** (**$p<0.05$**).
    - **Splints-only group**: Clearance reduced from **17.9 minutes to 14.6 minutes** (**$p<0.05$**).

These results highlight the positive impact of both treatment modalities on improving mucociliary clearance, particularly in smokers, who showed greater improvements post-treatment (**Fig. 53**).

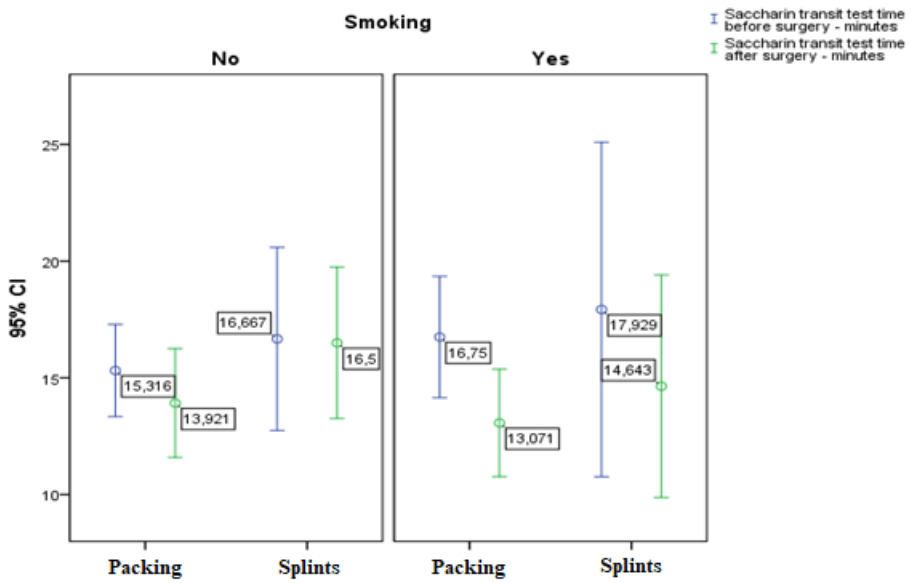


Fig. 53. Mucociliary Clearance by treatment with packing or splints and smoking status

3.5. Evaluation of the Impact of Postoperative Intranasal Packings and Splints on Bacterial Colonization and Risk of Infection

The study of the impact of postoperative intranasal packings and splints on bacterial colonization and infection risk revealed the following:

- **Preoperative results**: Positive microbiological findings were observed in **12.2%** of patients.
- **Postoperative results**: The proportion of positive microbiological findings increased to **17.3%** of patients.

It was found that **septoplasty** increased the risk of positive microbiological results by **1.7 times** compared to rhinoplasty (**OR=1.7; 0.225–12.556; p<0.05**). This association underscores the slightly higher risk of bacterial colonization and infection in patients undergoing septoplasty (**Fig. 54**).

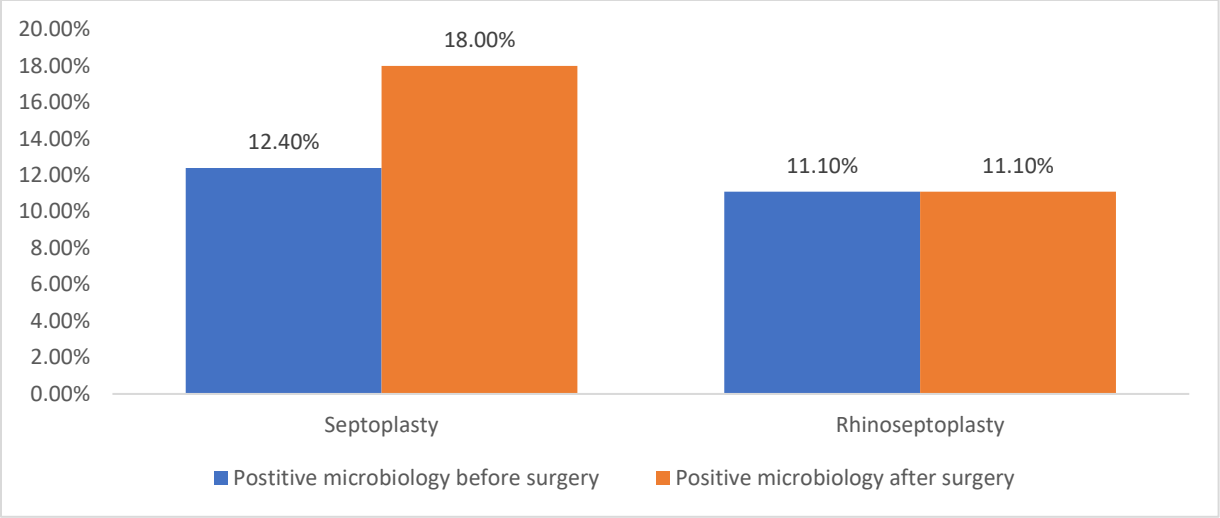


Fig. 54. Positive Microbiology results before and after treatment by type of surgery

A significant difference (**p<0.05**) was observed based on the type of postoperative treatment:

- Among patients treated with **splints only**, the rate of positive microbiological results **almost doubled** post-treatment compared to those treated with **packing**.
- This indicates that patients treated solely with splints might have a higher risk of bacterial colonization and infection postoperatively (**Fig. 55**).

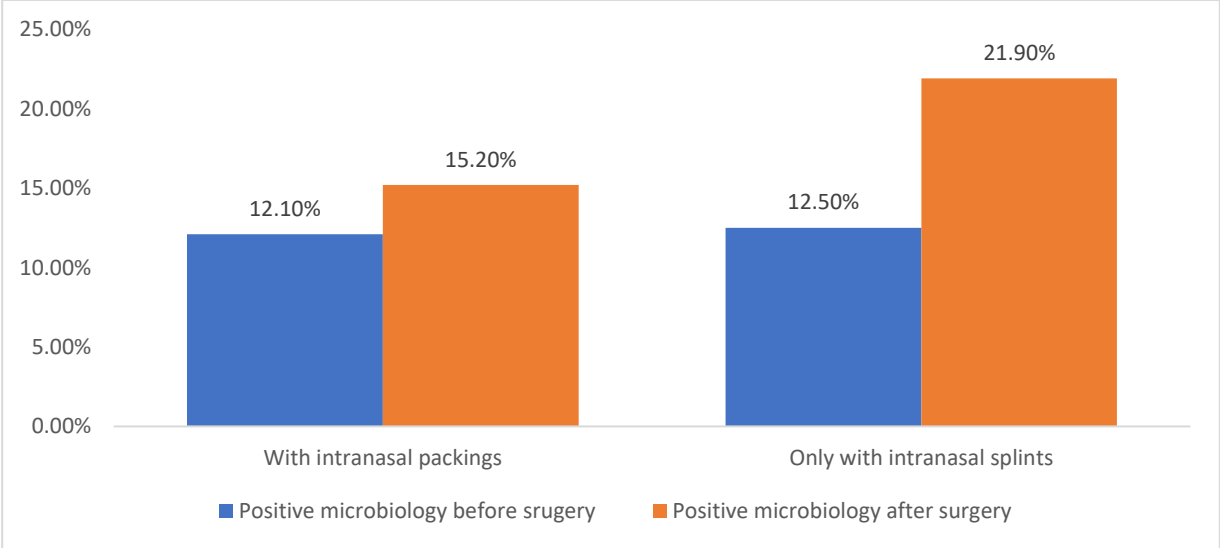


Fig. 55. Positive Microbiology results before and after treatment by type of intervention

The use of splints was associated with a **1.57-fold increased risk** of positive microbiological findings (**OR=1.57; 0.535–4.593; p<0.05**).

This highlights the potential role of splints in increasing the risk of bacterial colonization postoperatively, emphasizing the need for careful monitoring and infection prevention strategies.

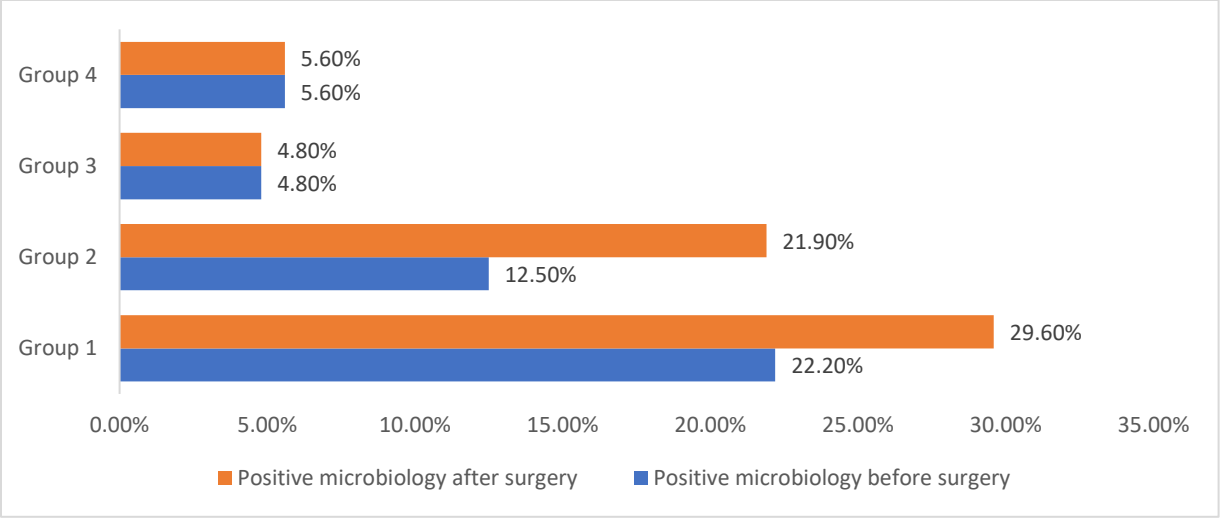


Fig. 56. Positive Microbiology Results before and after treatment by groups

Key findings:

- A significant difference (**p=0.042**) was observed in the proportion of positive microbiological results between patients treated with **sutures, splints, and gauze packing** and those treated with **sutures and splints with air channels**.
- A **weak to moderate correlation** (**r=0.263; p=0.009**) was identified between positive microbiology results and the type of intervention.

Importantly, despite the positive microbiological findings, no patient developed a clinically significant nasal infection.

3.6. Guidelines for the Use of Intranasal Packings and Splints After (Rhino)Septoplasty

To establish guidelines for the use of intranasal packings and splints after septoplasty, a risk analysis was conducted to evaluate the likelihood of complications and other conditions in the postoperative period.

Risk Analysis Results:

1. **Treatment Without Sutures**:
    - Associated with a **higher risk** for patients with:
        - **Hypertension**: **RR=1.8** (0.427–7.588, **p<0.05**).
        - **Asthma**: **RR=1.5** (0.148–15.414, **p<0.05**).
2. **Smoking**:
    - Identified as a **risk factor** in patients treated with sutures (**OR=3.3** (1.133–9.810), **p=0.023**).
3. **Sutures and Hematoma Risk**:
    - Treatment with sutures **reduces the risk of hematoma** (**OR=0.167** (0.107–0.261), **p=0.032**).

- A **moderate correlation** (**r=0.304; p=0.002**) was found between the risk of hematoma and the type of intervention (with or without sutures).

These results provide critical insights into the relative risks and benefits associated with different treatment approaches, aiding in the formulation of postoperative care recommendations.

The analysis of postoperative treatments revealed that treatment without sutures and using packing increases the risk of postoperative discomfort by 1.8 times, with a relative risk of 1.805 (confidence interval 0.929–3.506, p=0.028). For patients with diabetes, the use of intranasal splints was found to pose an increased risk, with an odds ratio of 2.1 (confidence interval 0.287–15.880, $p<0.05$). Additionally, treatment involving packing was associated with a greater likelihood of postoperative pain compared to the use of splints, with an odds ratio of 2.357 (confidence interval 1.214–4.578, $p<0.05$).

Septal splints offer several benefits that make them a valuable tool in postoperative care. They enhance the healing process by moisturizing the mucosa, especially in cases where the septal mucosa is injured, as highlighted in studies by Jung YG and colleagues (2011) and Lee JY & Lee SW (2007). Furthermore, septal splints provide mechanical protection to the mucosa, preventing unexpected trauma during postoperative care. They also stabilize remaining cartilage and support stretched mucosa, ultimately contributing to better correction outcomes. Due to these advantages, septal splints are recommended, particularly in cases involving mucosal injury.

However, septal splints also have some disadvantages that should be carefully considered. They are relatively more expensive than traditional packing materials, which may impact their accessibility in some cases. Despite improvements in their design, splints can still cause discomfort due to their structure or the formation of crusting around them. In rare cases, complications such as toxic shock syndrome have been reported, as in the case described by Wagner R. and Toback JM. (1986), where a patient received plastic septal splints without additional packing after septoplasty. Additionally, the use of splints may prolong surgical time due to the extra steps required for their placement and fixation.

In conclusion, surgeons should make patient-specific decisions regarding the choice of postoperative materials, carefully balancing the benefits and risks of septal splints and packing. While septal splints offer significant advantages, particularly in cases involving mucosal injury, considerations of cost, potential patient discomfort, and rare complications must also be taken into account.

Advantages and Disadvantages of Intranasal Packings and Splints

The primary disadvantage associated with nasal packing in patients undergoing (rhino)septoplasty is the **postoperative pain and discomfort** it often causes. Additional potential drawbacks or complications include worsening of impaired breathing, a sensation of fullness in the nasal passages, xerostomia (dry mouth), and postoperative infections.

Efforts have been made to mitigate these drawbacks and complications through strategies such as reducing the duration of nasal packing and modifying the materials used for the packings. However, the wide variety of available materials and techniques complicates a clear assessment of the risks associated with postoperative nasal packing following (rhino)septoplasty.

Although the risks associated with nasal packing can be minimized through careful management, the possibility of complications necessitates a thorough evaluation of the role and importance of nasal packings in postoperative care after septoplasty.

Conclusions

1. The study results indicate that the proportion of patients experiencing severe and unbearable discomfort in the postoperative period is lower among those treated with **gauze packing** compared to **PVA packing** (58% vs. 76.2%, respectively).
2. A **moderate to strong positive correlation** was established between discomfort and pain during packing removal, with the correlation being more pronounced in **women** (**r=0.594**) compared to **men** (**r=0.357**).
3. No significant difference in discomfort and pain was observed based on the type of splints used. The majority of patients reported experiencing mild discomfort and pain in the postoperative period (more than 50%).
4. In the group of patients treated without sutures but with splints and packing, a **strong correlation** was observed between the condition before packing removal and that before splint removal regarding discomfort. In contrast, patients treated with sutures and splints without air channels combined with gauze or PVA packing exhibited a **moderate correlation**.
5. Analysis revealed that patients treated with **splints with air channels** experienced **less discomfort and pain** compared to those treated with nasal packings.
6. Smoking was found to **prolong mucociliary clearance** by an average of **9%** before surgical intervention.
7. A significant difference in mucociliary clearance before and after surgery was identified depending on the type of intranasal packing. This difference was more pronounced among **smokers** and patients treated with **gauze packing**.
8. The study results regarding the impact of splints on bacterial colonization and infection risk showed that:
    - **Septoplasty** increases the risk of positive microbiological findings by **1.7 times**.
    - Treatment with splints increases the risk by **1.57 times**.
9. The incidence of early and late complications following rhinologic surgeries was **3%** with the intranasal devices used. This demonstrates that the procedures are characterized by a **high level of safety and minimal risk of complications** for patients.

Conclusion

Septoplasty is the most commonly performed procedure by ENT surgeons to treat nasal obstruction caused by a deviated nasal septum. Intranasal septal splints are utilized to prevent septal hematomas and adhesions. Similarly, nasal packing is used for the same purposes, but it often causes pain and discomfort in most patients. It is believed that the use of nasal packing after septoplasty further stabilizes the newly shaped septum and prevents complications such as bleeding, septal hematomas, and synechiae formation. While these claims seem intuitive, there is limited evidence supporting the routine use of postoperative packing for reducing complications or improving surgical outcomes. Assessing the efficacy and complications of nasal packing is complicated by the wide variety of materials and techniques available. Nevertheless, increased postoperative pain is consistently reported with the use of intranasal packing.

The use of septal splints instead of packing is associated with less postoperative pain for patients. The routine use of splints reduces postoperative complications and improves surgical outcomes compared to intranasal packing, while also causing less discomfort for patients. Therefore, the placement of intranasal packing after septoplasty should be reserved for cases where it is explicitly necessary.

The primary aim of this study was to examine the effects of different types of intranasal packings and splints following (rhino)septoplasty. This included evaluating patient discomfort and pain during the postoperative period with packings and splints, as well as during their removal. Additionally, mucociliary clearance was assessed using the saccharin test across different intranasal packing methods, and the risk of developing clinically significant infections was determined.

Our findings align with other similar studies, which highlight the negative effects of intranasal packing regardless of the material used. These include increased pain and discomfort for patients and minor bleeding during removal. Routine use of nasal packing is not justified for all patients after (rhino)septoplasty. In contrast, the use of intranasal splints significantly impacts surgical outcomes while causing relatively less discomfort and pain for patients.

According to our results, none of the studied patient groups developed clinically significant infections, though these findings occurred in the context of antibiotic prophylaxis. Further prospective studies are needed to clarify the necessity of antibiotic prophylaxis after (rhino)septoplasty.

We also examined mucociliary clearance before and after surgery, comparing results between smokers and non-smokers, as well as among different types of intranasal packing. Shortening of clearance time was observed after surgery across all packing methods, with the most significant reduction seen in the group treated with PVA packing.

Based on current data, the use of **intranasal silicone splints**, preferably with breathing channels, is recommended after (rhino)septoplasty, while routine intranasal packing is not necessary.

From our findings, we propose the following recommendations:

- Use of **transseptal sutures with absorbable materials** to prevent septal hematomas, as their absence increases the risk of hematoma formation.
- Application of **silicone splints** for 7 days, preferably with integrated air channels, to stabilize the septum, prevent synechiae, and support the newly shaped septum. Splints with air channels improve patient comfort in the postoperative period.
- Routine use of intranasal packing is not recommended, as its benefits do not outweigh its drawbacks. Packing should only be used in selected cases, particularly those involving significant intraoperative bleeding.

Contributions

Theoretical Contributions

1. A comprehensive literature review was conducted on the application, types, benefits, and drawbacks of postoperative intranasal packings and splints, as well as their effectiveness and impact on patient outcomes.
2. A detailed comparative analysis was performed on the effectiveness and influence of treatments involving packings and splints on the postoperative condition of patients.

Practical Contributions

1. The advantages and disadvantages of treatments with intranasal packings versus splints were presented in detail.
2. The impact of harmful habits, such as smoking, on mucociliary clearance in the context of various surgical interventions was demonstrated.
3. The effectiveness of intranasal packings and splints as a safe treatment method with minimal risk of complications for patients was confirmed.
4. Guidelines for the use of intranasal packings and splints after septoplasty were developed.

List of Publications Related to the Dissertation

1. Ivanova P., Iliev G. *Intranasal Splints as an Alternative to Intranasal Packing Following Septoplasty: A Literature Review.* Varna Medical Forum, ISSN 2367-5519, Vol. 12, 2023, Issue 1, pp. 113-121, DOI: http://dx.doi.org/10.14748/vmf.v12i1.8911.
2. Ivanova PP, Iliev G. *Nasal Packing in Septal Surgery: A Narrative Review.* Cureus, 2023 Mar 21; 15(3):e36488. DOI: 10.7759/cureus.36488. PMID: 37090361; PMCID: PMC10118399.

Conference Presentations Related to the Dissertation

1. Ivanova P., Iliev G. *Postoperative Intranasal Packing and Splinting - Effectiveness, Patient's Comfort, Clinical Outcomes.* Presented at the European Rhinologic Society Congress 2021, Thessaloniki, Greece, September 2021.
2. Ivanova P., Shevketova M., Shivarov G. *Contemporary Profile of a Patient with Epistaxis.* Presented at CEORL-NHS 2024, Dublin, Ireland, June 2024.